I. Introduction

The Suisun Marsh is the largest contiguous brackish water wetland in California. It is an important wetland on the Pacific Flyway, providing food and habitat for migratory birds. The lands and waters of this unique ecosystem also are home to a wide variety of plants, fish and wildlife that depend on a careful balancing of fresh and saline waters for their survival. The Suisun Marsh is located within the Bay-Delta estuary, which also means that its water quality affects, and is affected by, California's two largest water supply systems, the Federal Central Valley Project, and the State Water Project, and other upstream diversions.

These factors have made the Suisun Marsh one of the most highly regulated wildlife habitat areas in California, and have given it a prominent place in the CALFED Bay-Delta Program, a joint state-federal planning group formed to balance competing water needs and protect the Bay-Delta ecosystem.

CALFED and the member agency managers with primary responsibility for actions in Suisun Marsh formed a Charter Group to develop an implementation plan for Suisun Marsh that would protect and enhance Pacific Flyway and existing wildlife values, endangered species, and water-project supply quality. Because the Marsh includes private lands, the Suisun Resource Conservation District also serves on the Charter Group to represent the interests of private landowners. Other members are U.S. Fish and Wildlife Service (FWS), California Department of Fish and Game (DFG), U.S. Bureau of Reclamation (BOR), and California Department of Water Resources (DWR). The Charter Group has also consulted other CALFED participating agencies, including the National Marine Fisheries Service (NMFS) and U.S. Army Corps of Engineers (COE), in developing this Plan.

PURPOSE / GOALS AND OBJECTIVES

The purpose of this Plan is to provide for regional ecosystem restoration in Suisun Marsh. The Plan will outline the actions necessary to preserve and enhance managed seasonal wetlands and protect water quality, while restoring habitat for tidal marsh dependent sensitive species, consistent with CALFED's strategic goals and objectives and Record of Decision (ROD) for the Suisun Marsh.

The Plan is intended to balance implementation of management and restoration programs within Suisun Marsh in a manner that is responsive to the concerns of stakeholders, and based upon voluntary participation by private land owners.

The Plan is designed to achieve CALFED restoration milestones, and develop actions that will lead to recovery of listed species within the Marsh. To the extent possible, the Plan resolves permitting issues related to past and ongoing maintenance and management activities, and identifies and resolves other inter-agency conflicts related to the management of the Suisun Marsh. The Plan also provides for approval of an amendment to the Suisun Marsh Preservation Agreement (SMPA), and for implementation of CALFED's Suisun Marsh levee program.

The Plan contains a science element, to provide guidance on identifying and responding to the beneficial and adverse interrelationships among actions, and to guide development of testable hypotheses in the context of adaptive management. The CALFED science program will be utilized in implementing the Plan. CALFED wants a single blueprint for restoration and species recovery within geographic regions. This Plan will serve as the blueprint for the Suisun Marsh.

The Plan includes a brief background on the Suisun Marsh and a description of relevant legislation and planning documents. There is a discussion of key issues, and a description of the approach used to resolve them.

NEEDS

The Suisun Marsh Charter Agencies (FWS, BOR, DFG, DWR, and SRCD) identified three fundamental needs to be addressed in the development of this Plan and to address while implementing future activities in Suisun Marsh. The Agencies have recognized that a durable plan for the Suisun Marsh must provide for simultaneous protection and enhancement of 1) pacific flyway and existing wildlife values in managed wetlands; 2) endangered species recovery; and 3) water-project supply quality.

Existing Habitat Values

The location of Suisun Marsh on the Pacific flyway makes it a key wintering waterfowl and migratory bird habitat that also supports a historical hunting heritage. The fundamental need is to protect and enhance waterfowl and migratory bird habitat as an essential link of the flyway, and a resource for private landowners and the recreating public.

Endangered Species Recovery

The Marsh is a unique ecosystem harboring threatened, endangered, and sensitive plant, animal and fish species. Wildlife, including the salt marsh harvest mouse and California clapper rail, plants, including soft bird's beak and Suisun thistle, and fish species, including delta smelt, Sacramento splittail, and salmonids, are targets of recovery actions by State and Federal agencies.

The Salt Marsh Harvest Mouse, California clapper rail, soft bird's beak and Suisun thistle, which traditionally are thought to depend on tidal marsh habitat, are listed as endangered under the Federal Endangered Species Act. Tidal sloughs in the Marsh provide important rearing habitat for the delta smelt and Sacramento splittail, two federally listed threatened fish species. The purpose of the Endangered Species Act is to conserve ecosystems on which endangered species depend so they may be recovered. Therefore, the Plan will outline a means to balance recovery actions with waterfowl management in the Marsh.

Water Quality

The physical location and geometric configuration of the Marsh affects Delta water quality on a scale that could impact the economy and quality of life in California. Modeling studies have

demonstrated the need to protect some Suisun Marsh levees from catastrophic levee breaches to protect Delta water quality. The same studies also reveal opportunities for Delta water quality improvement with selected modifications to Suisun Marsh geometry. There is also a need for reliable flood protection to protect the Delta from salinity intrusion. In addition, the State and Federal water projects are obligated to meet state water quality standards in the Estuary and specifically Suisun Marsh to protect water quality.

CONSISTENCY WITH CALFED / CHARTER IMPLEMENTATION

Existing CALFED programmatic documents provide guidance for implementation of ecosystem restoration activities in the Suisun Marsh. These documents include the Framework for Action, the Ecosystem Restoration Program (ERP) Plan, the Multi-Species Conservation Strategy (MSCS), the Record of Decision (ROD), and associated documents including biological opinions, Natural Community Conservation Planning (NCCP) determination, and milestones.

This Plan is more specific than CALFED's ERP Plan and provides the additional detail needed to prioritize, select, and implement actions for the Suisun Marsh.

The CALFED Bay-Delta Program was established to reduce conflicts in the Bay-Delta system by solving problems in ecosystem quality, water quality, water supply reliability, and levee system integrity. The mission of the CALFED Bay-Delta Program is to develop a long-term, comprehensive plan that will restore the ecological health and improve water management for beneficial uses of the Bay-Delta system.

CALFED's objective for ecosystem restoration is to improve and increase aquatic and terrestrial habitats and to improve ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animal species. All CALFED elements will contribute in varying degrees, but the ERP is the principal program element designed to restore the ecological health of the Bay-Delta ecosystem.

SUISUN MARSH CHARTER

The Charter Group was formed at the request of CALFED to resolve issues of amending the SMPA, and to agree on a long-term implementation plan for the Suisun Marsh. The Suisun Marsh Charter Implementation Plan is intended to provide a coordinated and comprehensive solution for Suisun Marsh that will resolve the conflicts that had escalated over Amendment Three to the SMPA, the Regional General Permit, the levee investigations, and endangered species recovery.

[PUT THE CHARTER HERE, IN A BOX, TITLED SUISUN MARSH CHARTER]

II. Background

HISTORY OF LEGISLATION AND ADMINISTRATIVE ACTIONS

In the 1960s and 1970s, new laws and administrative and court decisions were made that increased environmental protection requirements, which greatly changed the rules for management of wetlands. The laws and actions most relevant to the Suisun Marsh are summarized below. Additional detail on these laws and administrative actions is in **Appendix XX. [JD has this appendix]**

Laws and Administrative Actions Affecting Suisun Marsh

1959	Delta Protection Act passed by Legislature to resolve some issues of legal boundaries, salinity control, and water exportation.
1963	Suisun Soil Conservation District (SSCD) formed by private landowners in Suisun Marsh.
1970	The Suisun Resource Conservation District (SRCD) was formed from the SSCD. SRCD was developed to perform administrative, regulatory, and technical functions representing landowner interests, both individually and collectively. These include obtaining environmental permits for routine maintenance; preparing wetland management plans; and providing technical expertise related to marsh management.
1970	National Environmental Protection Act, the California Environmental Quality Act, and California Endangered Species Act enacted
1970	Memorandum of Agreement between BOR, FWS, DWR and DFG to select a water supply and Suisun Marsh management plan to protect and enhance waterfowl habitat
1972	Federal Clean Water Act passed
1973	Federal Endangered Species Act passed
1974	Federal Safe Drinking Water Act passed
1974	Suisun Marsh Preservation Act passed by California Legislature. The Act required DFG and the San Francisco Bay Conservation and Development Commission (BCDC) to develop a plan to protect the Marsh.
1976	Suisun Marsh Protection Plan required by Suisun Marsh Preservation Act completed by DFG and BCDC and submitted to the Governor and Legislature.

1977 Assembly Bill 1717, passed by State Legislature, added Suisun Marsh Protection Act to the Public Resources Code and legislated the protective measures outlined in the SMPP.

1978 Water Rights Decision 1485 (D-1485), of the State Water Resources Control Board (SWRCB), set channel water salinity standards for Suisun Marsh from October through May to preserve the area as a brackish water tidal marsh and to provide optimum waterfowl food plant production. D-1485 placed operational conditions on water right permits for the CVP and SWP, and required the permittees to develop and implement a plan to ensure that the salinity standards would be met.

1978 Agreement for the Initial Facilities was signed by DWR, DFG, and SRCD which defined responsibility for construction, operation, and maintenance of Initial Facilities intended to partially mitigate the adverse effects of the SWP and CVP. Initial Facilities were: Morrow Island Distribution System, Roaring River Distribution System, and the Goodyear Slough Outfall.

1984 Plan of Protection for Suisun March, required by D-1485, was completed. The Plan of Protection proposed staged implementation of a combination of activities including monitoring, a wetlands management program for Marsh landowners, physical facilities, and supplemental releases of water from CVP and SWP reservoirs. With staged implementation, each action would be evaluated to determine the need for subsequent actions.

1985 Amendment of D-1485 extended the effective dates and modified the location criteria of the channel water standards.

1987 Suisun Marsh Preservation Agreement (SMPA) between DWR, DFG, BOR, and SRCD set objectives for the Marsh and established a plan for the objectives to be met. SMPA set a schedule for construction of large-scale facilities in the Marsh that would enable salinity standards to be met. BOR and DWR had responsibility for funding and constructing the facilities and for meeting the salinity standards. Construction was to be in phases, based on evaluation of need and effectiveness of the facility previously constructed. The Suisun Marsh Salinity Control Gates were built in 1988, the Cygnus Unit in 1991, and the Lower Joice Island Unit in 1993. DWR and BOR stopped planning work for the Western Suisun Marsh Salinity Control Project in April 1995, because increased outflows and the effectiveness of the salinity control gates allowed standards to be met.

1987 Suisun Marsh Mitigation Agreement and Monitoring Agreement were companion agreements to the SMPA. The first provided for land acquisition and management for mitigation of loss and degradation of wildlife habitat from projects and diversions. The second specified the monitoring program requirements.

1994 Bay-Delta Accord reached among government agencies and stakeholders, leading to interim water quality standards to protect the estuary and provide water supply reliability

1995 Decision to Amend the SMPA: SRCD, DWR, BOR and DFG agreed that some additional salinity control facilities were not needed. Instead, they agreed to negotiate Amendment Three, which focused on improving management on private lands. (Two previous amendments modified construction details and financial arrangements.)

1995 Water Quality Control Plan was adopted by SWRCB for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary. The plan defines beneficial uses to be protected, water quality objectives for their protection, and a program to implement those objectives.

1995 Water Rights Order WR 95-6, an interim order issued in response to a joint DWR and BOR petition, replaced the water quality standards for fish and wildlife in D-1485 to conform with the 1994 Accord and the 1995 Water Quality Control Plan, leaving all other provisions in force. SWRCB has granted several extensions, pending setting of new standards.

1995 Suisun Ecological Workgroup (SEW), a technical work group convened at the request of SWRCB to implement its 1995 Water Quality Control Plan. SEW was asked to address the uncertainty of the effectiveness of the plan's delta outflow objectives on tidal wetlands.

The SMPA Amendment Three and Suisun Ecological Workgroup are parallel processes that focus on different aspects of Marsh protection. The SMPA focuses on protection of managed wetlands, while the SEW is developing recommendations for SWRCB for comprehensive water quality standards that will protect tidal marsh, aquatic, and managed marsh habitats.

1995 CALFED, a joint State-Federal planning organization, is established to develop a Bay-Delta solution for problems of competing water needs, environmental protection, water quality, and water reliability, with stakeholder and public involvement in decisions.

1996 SMPA agencies begin negotiations for Amendment Three.

1998 Water Rights Order WR 98-9. In December 1998, the SWRCB adopted Order WR 98-9 to extend the provisions of Order WR 95-6, with minor modifications, through December 31, 1999.

1998 SMPA Agencies Environmental Coordination Advisory Team formed. The SMPA agencies, along with FWS and USACE begin ECAT meetings to resolve outstanding Suisun Marsh mitigation compliance issues and address current and future monitoring needs.

1999 Joint Consultation for Amendment Three and The Regional General Permit. BOR and USACE initiate joint formal consultation for A3 and the RGP renewal.

1999 Water Rights Decision WR-1641 adopted by SWRCB 12/99, which outlined SWP and CVP obligations in the Marsh.

2000 CALFED Policy Group requests FWS and DFG to develop a Charter for the Suisun Marsh. DFG and FWS bring in DWR, BOR and SRCD to work together.

2001 Suisun Marsh Charter is finalized and presented to the CALFED Policy Group. The group begins to develop this plan.

(See **Appendix XX** for more detail on the relevant legislative and administrative actions affecting Suisun Marsh.) **[JD has this appendix – needs identification]**

III. Existing Conditions

EXISTING HABITAT AND LAND USE

Physical Description

The Suisun Marsh is located in southern Solano County, California, west of the Sacramento-San Joaquin Delta and north of Suisun Bay (see **Figure 1**). This intricate mosaic of tidal wetlands, diked seasonal wetlands, sloughs, and upland grasslands comprises over 10% of the remaining wetlands in California, and is an important part of the San Francisco Bay-Delta Estuary. The Suisun Marsh provides habitats for many species of plants, fish, and wildlife, in addition to wintering and nesting habitat for waterfowl on the Pacific Flyway. Suisun Marsh is a brackish marsh due to the combined influences of saline ocean water from Suisun Bay and fresh water from the Sacramento-San Joaquin Delta.

The Suisun Marsh was originally formed by the deposition of silt particles from flood waters of Suisun Slough, Montezuma Slough, and the Sacramento-San Joaquin river network. In its original state, the Suisun Marsh consisted of islands separated by a network of tidal sloughs. Large portions of these islands were submerged daily by the high tides, while larger tracts of land were submerged during seasonal high tides and winter flood events. The salinity of the water in the sloughs of the Suisun Marsh varied considerably with season and from year to year. High winter and spring outflows from the Delta and local streams flooded the Suisun Marsh and provided fresh water in its channels. During periods of low outflow, saline water from the bay gradually replaced the fresh water in Suisun Marsh channels, resulting in high salinity for periods of up to five months or more each year (DPW 1931a, DWR Bulletin No. 28, Economic Aspects of a Salt Water Barrier Below Confluence of Sacramento and San Joaquin Rivers).

Historic Land Use

Prior to the arrival of Spanish explorers in the late 1700's and gold seekers in the mid-1800s, the Suisun Marsh was inhabited by three or four native tribes. These Native Americans harvested local natural resources for their survival and probably didn't alter land use in a significant way. Duck clubs first were founded in naturally ponded areas of the western Marsh during the 1870's. The diking of the Suisun Marsh began in 1865, initially to enable livestock grazing on the eastern portion of the Marsh. Levee construction began in the 1870's and a low levee system surrounded Grizzly Island by 1876.

By the early 1900's grazing in the Marsh had given way to more lucrative farming efforts. A variety of crops were grown including sugar beets, asparagus, lima beans, oats, and barley, along with livestock and dairy products. Several dry years and upstream water diversions caused the water to become increasingly saline in the Suisun Marsh and agriculture began to fail. Some farming persisted into the 1950's but duck clubs ultimately displaced agriculture almost completely.

Grizzly Island Wildlife Area

The Grizzly Island Wildlife Area, owned by DFG, comprises 15,030 acres within the Suisun Marsh. Acquisition of State land in Suisun Marsh began in 1931 with the purchase of the Joice Island Unit. Grizzly Island was acquired in 1951. At 8,600 acres, Grizzly Island is the largest component of the GIWA and the hub of much of the management efforts and public recreation activities. The GIWA also includes the Crescent, Garibaldi, Grey Goose, Gold Hills, Goodyear Slough Units, Island Slough Mitigation Area and the Montezuma Slough access (formerly Beldons Landing), Peytonia Slough Ecological Reserve and the Hill Slough Wildlife Area. DFG holdings include managed and tidal areas.

During the 1940's, DFG defined the three purposes of "State Game Refuges". These purposes were:

- Provide wintering habitat for waterfowl
- Minimize crop depredation by providing resting and feeding areas for waterfowl
- Provide for public waterfowl hunting

In the 1970's, these areas changed again from "waterfowl management areas" to "wildlife areas" where preservation of the habitat and associated public use for all wildlife became the fourth purpose of these areas.

Waterfowl Values

Development has reduced waterfowl habitat in California from its original over 5,000,000 acres to less than 500,000 acres. Wintering waterfowl numbers have not declined proportionately. Although original populations are unknown, they have they have only declined approximately 15% since the 1950's. Despite the loss of wetlands, the Central Valley of California winters approximately 60% of the waterfowl in the Pacific Flyway (approximately 20% of North American waterfowl). Loss of wetland habitat has concentrated waterfowl into the limited amount of remaining habitat, magnifying the value of each acre of seasonal wetland.

Suisun Marsh remains an important waterfowl habitat in California. It represents approximately 13% of California's remaining wetlands and has historically wintered up to 28% of the wintering waterfowl in California. Suisun Marsh water supplies are very stable, which makes the Marsh especially important to waterfowl in times of drought. Central Valley water supplies will be reduced during times of drought and there are often cost issues related to the need for electricity to pump groundwater.

Because of its great ecological importance, the Suisun Marsh Preservation Act was passed in 1977 to set the Marsh aside for resource management. The Suisun Marsh provides habitat for some 300 species of migrating and resident wildlife or plants. Of these, there are 12 species that are rare, threatened, or endangered.

Types / Amounts of Acreage

Suisun Resource Conservation District boundaries encompass approximately 52,000 acres of diked wetlands, 6,300 acres of tidal wetlands, 30,000 acres of bays and sloughs, and 27,000 acres of upland grasslands. Most of the diked wetlands are managed for waterfowl hunting; acreage devoted to grazing and agriculture is very small. DFG owns an additional 15,300 acres of tidal wetlands, diked wetlands, and upland grasslands.

Recreation

The most numerous recreational users of the Suisun Marsh are fishermen, who spend approximately 51,000 fisher days there each year. Hunters spend approximately 50,000 hunter days each waterfowl season. Nature study, birdwatching, and photography are recreational pursuits that have been increasing in the past few years. It is estimated that some 18,000 non-consumptive use days are spent in the Marsh annually.

EXISTING OPERATIONS/ FACILITIES

Managed Wetland Operations

Most wetland managers in the Suisun Marsh begin flooding the wetlands in late September or early October, in preparation for the fall migration of waterfowl.

When possible, wetland managers of the Suisun Marsh use gravity flow to fill and drain their wetland areas. Consequently, the wetlands are filled during high tide, when applied water salinity is typically the greatest, and the water can flow through the inlet gates (flood facility) into the managed wetlands. The wetlands are drained during low tide, when water elevation in the diked wetlands is higher than that of the slough and water flows out through drain gates and into the slough.

During initial flood-up, the inlet gates are opened and the drain gates remain closed to allow the managed wetlands to fill to an average depth of 8-12 inches (waterfowl management level). After initial flood-up, water is circulated and then drained while maintaining water at the 8-12 inch depth. Compared to the initial flood-up period, relatively small amounts of water are exchanged between the sloughs and the ponds during the circulation. The circulation of water helps maintain water quality and prevents stagnant areas from developing. Circulation also helps prevent the increase in pond water salinity resulting from evaporation, and helps maintain natural soil salinities. The wetlands are dewatered in late January after waterfowl season to begin management activities, although some properties will hold water as late as mid-July for waterfowl brood habitat.

To produce a diverse assemblage of waterfowl and wildlife habitat on managed wetlands in Suisun Marsh, wetland managers must take into account factors such as soil water salinities, depth and duration of soil submergence, and applied water salinity, to prevent the accumulation of soil salinities above natural levels outlined by the U.S. Department of Agriculture (USDA) Soil Conservation Service (1977) for Suisun Marsh soils. Water level manipulations begin in

February and continue through March or July, depending on what water management schedule the landowners is following. These recommendations may be the early or late drawdown water management schedule, as outlined in the 1978 management plans, or some modification of these schedules. Typically the water remaining within the wetlands is drained form mid-March through mid-July to allow vegetative growth and to perform necessary routine maintenance activities during the summer.

The National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) have imposed water diversion restrictions on unscreened diversions in the Marsh, to avoid adverse impacts to delta smelt, winter-run and spring-run chinook salmon, and other resident native and anadromous fish populations. Therefore, implementing these water management schedules often cannot be achieved. Effective maintenance of soil salinities may not occur in properties with these new diversion restrictions in place, unless a fish screen has been installed.

To reduce mosquito production in the Marsh, Solano County Mosquito Abatement District does not recommend flooding before October 1, unless the landowner can flood and drain the wetlands within 10 days or is willing to pay for mosquito control spraying.

Wetland Management Strategies

Waterfowl food habits studies conducted in Suisun Marsh (George 1965) indicated that seeds from alkali bulrush (Scirpus maritimus), fat hen (Atriplex triangularis), and brass buttons (Cotula coronopifolia) provided the bulk of winter waterfowl food supply. This study was the basis for future studies (Mall 1969; Rollins 1973) on habitat conditions necessary to produce these seed bearing plants. These studies concluded the plant communities in the Suisun Marsh are controlled primarily by the depth and duration of soil submergence and secondarily by the concentration of salts in the root zone.

In the late 1970s, the Soil Conservation Service prepared management plans for each of the 158 privately managed wetlands in the Suisun Marsh. DFG also prepared management plans for State-owned land in the Marsh, which follow similar management regimes and schedules as the private properties. These outdated management plans have not been modified or updated since they were written over 20 years ago, and no longer reflect the current environmental, regulatory, or physical constraints which occur in the Suisun Marsh managed wetlands today.

At the time these management plans were written, they presented the most recent scientific information available to provide water management schedules, with the intent to produce waterfowl food plants and leach soil salts from the root zone (Rollins 1981). These plans recommended effectively leaching soil salts from the root zone by removing water from the upper foot of the soil profile. Performing leach cycles, rapidly flooding and draining the wetlands one-foot below pond bottom for one or more cycles, accomplish this. These water management schedules recommended rigid dates for water application, drainage, and water levels within the ponds.

The water management schedules written by Rollins were intended to promote the growth of specific waterfowl food plants. The goal of the late drawdown schedule was to maximize

production of alkali bulrush and minimize production of tules (Scirpus acutus), cattails (Typha spp.), saltgrass (Distichlis spicada), and pickleweed (Salicornia virginica). The early drawdown schedule targeted fat hen while suppressing tules, cattails, and saltgrass growth. Only those ponds managed as permanent wetlands stay wet year around.

The outdated management plans and water management schedules were based upon the goal of single species management to produce the maximum production of waterfowl seed crops. The proposed adaptive management plans will vary dramatically from this previous approach. These plans will provide landowners scientific information and present multiple management options to produce a diverse mosaic of vegetation within the managed wetlands. This management goal will be obtained by: (1) maintaining soil water salinity levels within the natural salinity ranges characteristic of brackish marsh soils, as outlined by the USDA Soil conservation Service (1977); (2) considering resident and migratory waterfowl and wildlife habitat needs including those of threatened and endangered species; and (3) making management decisions based on yearly environmental factors, physical constraints, and regulatory restrictions.

The following factors will influence future adaptive management plans:

Physical Wetland Management Constraints:

- Wetlands soil types and natural salinities.
- Water control facilities: Gate size, location, elevation, pipe invert.
- Pond bottom elevation.
- Pond bottom topography.
- Ditch capacity, size, depth, and vegetative obstructions.

Environmental Constraints:

- Water year type.
- Applied water salinity.
- Climatic conditions, temperature, rain fall, seasonal variability.
- Pond water levels.
- Tidal variation at diversion and drainage points.
- Geographic location in relation to salinity gradients.

Endangered Species Considerations:

- Endangered species habitat protection.
- Endangered species habitat management goals.
- Endangered species fisheries protection through water diversion restrictions.

Regulatory Restrictions on Wetlands Maintenance Activities:

- Compliance with regional general permit conditions for work activities.

History of Suisun Marsh Diversion Screening Programs

Today over 20,500 acres of diked wetlands in the Suisun Marsh (more than 60 ownerships including DFG) have access to fish screened water.

Since 1980 there has been a diversion screening program in the Suisun Marsh. The first screening program began in 1980 at the Roaring River Fish Screen Facility. DWR and BOR built this facility as one of the initial facilities under the Plan of Protection. In 1995 and 1996, DFG constructed two fish screen facilities on DFG lands. The first screen was Grizzly Ditch drum screens and the second was the Island Slough flat plate screen.

In 1994, the SRCD began working with DFG to develop and implement the Suisun Marsh Fish Screen Program. This activity was in response to the Reasonable and Prudent Measures outlined in SRCD's U.S. Army Corps of Engineers regional maintenance permit (PNR20066E98) Section 7 Biological Opinions for Sacramento River winter-run Chinook salmon, Sacramento splittail and delta smelt. As a result, DFG completed a "Plan to Implement the Suisun Marsh Wetland Diversion Screening Program" This Plan outlined a methodology for prioritization of screen installation projects in the Suisun Marsh. This criteria established priority diversion screening areas in the Suisun Marsh based on information obtained from surveys of critical habitat areas of delta smelt, Sacramento splittail, and winter and spring-run Chinook salmon.

With the completion of the screening prioritization criteria, SRCD began implementing Phase 1 of the SRCD Suisun Marsh Diversion Screening Program. In 1996, the SRCD constructed 5 conical fish screens on privately owned managed wetlands. In 1997, the SRCD completed construction on five additional conical fish screens on privately owned lands, and one fish screen facility on Lower Joice Island under contract with DWR and BOR. A fish screen was required for the DWR / BOR construction of the Lower Joice Island intake facility. The SRCD completed construction of two additional conical fish screens in 1998, which completes a summary of all diversion screening activities in the Suisun Marsh today.

A fish screen was required in the 1999 biological opinion issued by FWS for maintenance dredging of the Morrow Island Distribution System. Since 1998, the SMPA agencies in ECAT looked into several alternative designs for fish screens, including habitat restoration for delta smelt recovery along the Goodyear Slough and elsewhere in the Marsh. A design was agreed to that included the installation of four conical screens at the intake and three installed along Goodyear to directly serve adjacent private ownerships. The cost of this project, estimated at 4.5 million dollars, in conjunction with fisheries benefits of screening at this location have resulted in the agencies looking into alternatives that may provide more benefit to the fisheries resource. The agencies, including NMFS are currently reevaluating the need for a fish screen at this location. Resolution of this process is expected in 2002.

Summary of Suisun Marsh Diversion Screening*:*

1980 - Roaring River Fish Screen Facility (DWR/ BOR)
1995 - Grizzly Ditch Fish Screen Facility (DFG)
1996 - Island Slough Fish Screen (DFG/ DWR/ BOR)
1996 - SRCD Phase 1 Diversion Screening Program (five screened diversions)
1997 - Lower Joice Island Fish Screen (funded by DWR/BOR, constructed by the SRCD)
1997 - SRCD Phase 2 Diversion Screening Program (five screened diversions)
1998 - SRCD Phase 2 Diversion Screening Program (two screened diversions)
2002 - Morrow Island Distribution Screening obligation (DWR/BOR)

The SRCD and DFG have continued efforts to implement the Suisun Marsh fish screening program to continue screening priority 1, 2, and 3 diversions in the Suisun Marsh. In 1997 and 1998, the SRCD applied for two CALFED grants to install seventeen and eleven fish screens (respectively). Both of these grant requests were not funded with the explanation given that the Suisun Marsh was considered a low priority area for screening and that the Sacramento River and Delta Region were higher priority areas.

To date, the SRCD has installed eleven conical fish screen facilities in the Suisun Marsh. Future implementation of this program will include evaluations of existing gravity flow diversions to determine the potential to downsize or consolidate the overall number of unscreened diversions in the Marsh. The biological importance of fish screens is to decrease the entrainment of sensitive native and anadromous fish species while allowing private landowners to effectively manage the seasonal wetlands for migratory waterbirds and resident wildlife.

DFG's plan to implement the Suisun Marsh Wetland Diversion Screening Program, including methodology for prioritization of screen installations, uses biological and non-biological criteria to identify potential sites. The biological criteria identifies critical habitat areas, long term resource benefits, and the potential to entrain fish. The non-biological criteria plays a secondary role in prioritizing diversions after the biological criteria is established.

<u>The biological criteria consists of</u>:
Priority 1 - Diversions directly off of Montezuma Slough, without intervening vegetated berms
Priority 2 - Diversions on Montezuma Slough located behind vegetated berms
Priority 3 - Diversions on Suisun Slough or Nurse Slough
Priority 4 - The balance of the Marsh

Size:
Priority 1 - Diversions larger than 36" in diameter
Priority 2 - Diversions between 24" and 36" in diameter
Priority 3 - Diversions smaller than 24" in diameter

The non-biological criteria consist of electrical source, commitment of landowner for long-term operation and maintenance of the screen facility, and permanency of diversion.

After the highest priority diversions were selected, a site evaluation is required, because fish screen design needs to withstand harsh brackish environmental conditions of the Suisun Marsh.

The SRCD Suisun Marsh Diversion Screening Program has specifically designed screen facilities to meet the unique conditions of the brackish tidal environment of the Suisun Marsh. To maximize life of the facility and minimize maintenance costs, the screens are constructed from corrosive resistant materials. To ensure efficient and effective operation, screens are designed to be readily removable for inspection and maintenance. This structural design also extends the life of the structure by allowing it to be removed from the water during periods of no diversions, which reduces the corrosive effects of the brackish environment. The screens are conical in shape, made from perforated stainless steel plate, with cleaning brushes driven by

submersible motors. A flow meter is installed within the polyethylene pipe to monitor flow and modulate gate operations to ensure that approach velocities at the screen do not exceed the design criteria with the daily tidal fluctuations. This screen design and it's facilities have been tested by National Marine Fisheries Service, and meet the criteria of approach velocities of 0.2 feet/sec for delta smelt and 0.33 feet/sec for salmon. These screen facilities are automated to operate unattended, but are monitored via radio communications to the SRCD office.

Maintenance Activities

Wetland managers in the Suisun marsh conduct ongoing maintenance to water control facilities and levees to sustain and improve waterfowl food plant productivity and wetland diversity and prevent uncontrollable flooding. Maintenance is usually conducted during the summer, when the ponds are dry.

Maintenance activities that are authorized by SRCD's Regional General Permit (RGP) #3 (file #24215N) include:

- Clearing existing interior ditches
- Constructing new interior ditches
- Repair interior existing levees
- Repair exterior existing levees
- Replace previously existing rip-rap on exterior levee
- Coring of existing levees
- Existing road maintenance: Adding surface material, and grading
- Existing parking lot maintenance: adding surface material, and grading
- Grading pond bottoms for water circulation
- Pond bottom spreader V-ditches
- Repair existing exterior floodgates and coupler
- Pipe replacement for existing floodgates
- Repair existing exterior drain gates and couplers
- Pipe replacement for existing drain gate
- Installation of a new exterior drain gate
- Install, repair, or re-install water control bulkheads
- Repair existing interior water control structures
- Installation of new interior water control structures
- Install new or relocate/replace existing blinds
- Discing
- Installation of drain pump and platforms

State/Federal Facilities

Several facilities have been constructed by DWR and BOR that operate in the Suisun Marsh. These facilities (**Figure XX**) are identified in the Plan of Protection for the Suisun Marsh and the 1987 SMPA. The purpose of these facilities is to provide lower salinity water to managed wetlands. The Initial Facilities, including the Roaring River Distribution System, Morrow Island Distribution System, and Goodyear Slough Outfall, were constructed in 1979 and 1980. The

Suisun Marsh Salinity Control Gates (SMSCG) were installed and became operational in 1988. Other facilities constructed under the SMPA include the Cygnus drain and the Lower Joice Island Diversion. The existing facilities are described in detail below. Several additional large-scale facilities are identified in the Plan of Protection for the Suisun Marsh and the original SMPA, and were to be phased-in for salinity control in the marsh. However, due to the effectiveness of the Initial Facilities and the SMSCG, and increased outflows, there are no plans to construct additional facilities.

Roaring River Distribution System

The Roaring River Distribution System was constructed in 1979-1980 to provide wetland managers on Simmons, Hammond, Van Sickle and Wheeler islands with lower salinity water. Construction involved enlarging the slough and extending its western end. Excavated material was used to widen and strengthen the levees on both sides of the system. A bank of eight 60-inch culverts brings lower salinity water into the system from Montezuma Slough. The culverts are equipped with a fish screen at the intake to minimize diversion of fish into Roaring River Slough. To provide an adequate water supply during fall flood-up, a pond was constructed near the confluence with Montezuma Slough to increase the capacity of the system. This system provides water for approximately 5,000 acres of managed wetlands.

Morrow Island Distribution System

The Morrow Island Distribution System, in the western marsh, was also constructed in 1979-1980. The system is composed of two channels known as M-line and C-line. The channels divert water from Goodyear Slough to the easternmost area of Morrow Island. The purpose of the system is to allow wetland managers to fill their ponds with lower salinity water from Goodyear Slough or the Distribution System and drain into Grizzly Bay or Suisun Slough. This reduces the introduction of high-salinity drainage water into Goodyear Slough.

Goodyear Slough Outfall

The Goodyear Slough Outfall was constructed to connect the south end of Goodyear Slough to Suisun Bay. Prior to construction of the Outfall, Goodyear Slough was a dead end run. The system was designed to increase circulation and reduce salinity in Goodyear Slough and to provide lower salinity water to the wetland managers who flood their ponds with Goodyear Slough water.

Suisun Marsh Salinity Control Gates

The Suisun Marsh Salinity Control Gates were completed and began operating in October 1988. The first year of operation was used to test the gates, and official operation began in November 1989. The facility consists of a boat lock, a series of three radial gates, and flashboards. The gates control salinity by restricting the flow of higher salinity water from Grizzly Bay into Montezuma Slough during incoming tides and retaining lower salinity Sacramento River water from the previous ebb tide. Operation of the gates in this fashion lowers salinity in Suisun Marsh channels and results in a net movement of water from east to west. When Delta outflow is low to

moderate and the gates are not operating, net movement of water is from west to east, resulting in higher salinity water in Montezuma Slough.

The Control Gates usually begin operating in early October and, depending on salinity conditions, may continue operating through the end of the control season in May. When the channel water salinity decreases sufficiently below the salinity standards, or at the end of the control season, the flashboards are removed and the gates raised to allow unrestricted movement through Montezuma Slough. Details of annual gate operations can be found in "Summary of Salinity Conditions in Suisun Marsh During Water Years 1984-1992" (DWR, 1994b), or the "Suisun Marsh Monitoring Program Data Summary" produced annually by DWR, Environmental Services Office.

Lower Joice Island Unit and Cynus Unit

Drain gates were installed on Lower Joice Island and on Ownership 415 as part of the SMPA. A fish screen was installed on Lower Joice Island in 1991. In 2001, the landowners of Lower Joice Island transferred ownership of the Island to SRCD. A condition of this transfer was that the island be maintained as waterfowl habitat.

Cost-Share Facilities

In addition to the above facilities, numerous small water control structures and pumps exist in the marsh, many of which were installed and/or replaced under the DWR and BOR individual cost-share program. The individual ownership cost-share program, as specified in the SMPA, is a program to improve the landowner's ability to drain managed wetlands. Under this program, DWR and BOR reimburse the landowners 75% of the cost of replacing culverts (enlarging and/or lowering) and drain gates, and installing pumps. The individual landowners are responsible for the remaining 25 percent. The proposed facilities must be specified as 'Needed Improvements' in the Individual Ownership Management Plans prior to being approved for inclusion in this program.

THREATENED AND ENDANGERED SPECIES RECOVERY

Status and Trends

Historic and prehistoric climate data show that Suisun Marsh was subjected to extreme variations in salinity due to prolonged wet and dry periods. Because of freshwater flows from the Delta, much of the Marsh was, and continues to be, less saline than the tidal salt marshes of San Francisco Bay. The salient hydrologic feature of Suisun Marsh is the variability of salinity due to natural cycles of high and low rainfall. Species dependent on tidal marshes for survival, particularly the Marsh's endemic plants, evolved in these variable conditions. More recent influences on salinity variability have been from water supply development, including dams, that have altered the natural cycles of outflow from the rivers. Current management of the Marsh controls the salinity of the water through Suisun's tidal sloughs.

Approximately 6,300 acres of tidal wetlands remain in Suisun, an 88% loss historic acreage. These tidal marshes are generally narrow fringes on the outboard sides of levees, although a few relict, undiked tidal marshes and sloughs remain in the northeastern Marsh. Four endangered species persist at low levels in scattered remnants of the historic marsh ecosystem. They are the salt marsh harvest mouse *(Reithrodontomys raviventris),* California clapper rail *(Rallus longirostris obsoletus),* soft birds' beak *(Cordylanthus mollis ssp. mollis),* and Suisun thistle *(Cirsium hydrophilum var. hydrophilum).* Two threatened fish species also occur in the Marsh: the delta smelt *(Hypomesus transpacificus)* and Sacramento splittail *(Pogonichthys macrolepidotus)*. Diked waterfowl wetlands provide little to no habitat for most tidal marsh species.

To recover threatened and endangered species, large areas of tidal restoration are needed. The Service's *Recovery Plan for Salt Marsh Harvest Mouse and California Clapper Rail* (Service 1984) had the goal of approximately 34,000 acres of restored tidal marsh in the San Francisco Bay Estuary. The Service is revising the 1984 Recovery Plan to include recovery actions for several listed plants and conservation actions for many other sensitive species dependent on tidal marshes in the Bay. The administrative draft *Recovery Plan for Tidal Marsh Ecosystems* (Service files) determined acreage for tidal restoration based on the ecological needs of the listed species. Approximately 20,000-25,000 acres of restored tidal marsh is necessary to downlist and delist the endangered species in Suisun. Implementing this recovery is expected to take 25-50 years. The SMPA agencies will not be responsible for the entire restoration acreage outlined in the administrative draft Recovery Plan. The Charter Agencies have agreed that the Implementation Plan will work toward meeting the CALFED milestone of 7,000 acres of restored marsh in 7 years. However, this Implementation Plan will outline the integration of future tidal restoration with existing land use and management actions in the Marsh.

Tidal restoration should receive the highest priority near major populations of endangered species and major sources of tidal sediments (adjacent to mudflats of Grizzly Bay, Suisun Bay, Honker Bay, and mouths of rivers and sloughs). Existing tidal marshes should be protected against impacts from filling, dredging, and salinity control gate operation. Maintenance activities on public and private lands, including mosquito abatement, should be conducted to minimize impacts to listed species.

Recovery Actions to Date

FWS has conducted several consultations with Federal agencies in Suisun Marsh on the effects of their actions on threatened and endangered species. In 1981, the Service issued a biological opinion on the Suisun Marsh Management Plan. The Service issued another opinion in 1986 addressing impacts associated with construction and operation of the Suisun Marsh Salinity Control Gates (SMSCG) (Service 1986). In 1994, the Service consulted informally by letter with the Corps on effects of the Regional General Permit on the clapper rail. In 1995 the Service issued a Biological Opinion for delta smelt and conference opinion for Sacramento splittail, proposed for listing at the time, for the Regional General Permit. In October of 1999, the Bureau and the Corps initiated consultation on Amendment 3 and the new RGP, and also reinitiated on all past biological opinions. Due to FWS concerns that the actions as proposed could jeopardize the continued existence of several species, SMPA parties and the Service decided to delay

completion of the consultation and include it as part of the consultation of the completed Implementation Plan.

One goal of the Conservation Measures in the 1981 biological opinion was to retain at least 2,500 acres of preferred salt marsh harvest mouse habitat adequately distributed throughout the Marsh. The SMPA agencies interpreted this to mean that any existing preferred harvest mouse habitat, regardless of its ownership or management, contributed to the 2,500-acre goal. However, the FWS intention was that the 2,500 acres would be set aside as Conservation Areas owned and managed by DFG. This difference in interpretation and other mitigation and monitoring concerns led to the formation of the Suisun Marsh Preservation Environmental Coordination Advisory Team in 1998.

In 1987, the SMPA agencies set aside seven areas totaling approximately 1,130 acres as required in the BO.

As a result of ECAT, the SMPA agencies agreed to "set aside" an additional 1500 acres as conservation areas for the harvest mouse. In 1999, DFG proposed seven new Conservation Areas totaling 3,050 acres, and the FWS has since accepted four of these areas. To date, SMPA agencies have set aside 2,201acres of State-owned managed and tidal wetlands. SMPA agencies are working to locate additional harvest mouse preserve sites.

[LEE: ADD ANY NMFS ACTIONS?]

WATER QUALITY

State Water Resources Control Board Standards

Standards Established to Achieve Target Spring Soil Salinity for Plant Germination

Past food habit studies conducted in Suisun Marsh (George, 1965) indicated that seeds from alkali bulrush (*Scirpus robustus*), fat hen (*Atriplex trianularius*), and brass buttons (*Cotula coronopifolia*) provided the bulk of wintering waterfowl food supply. Later studies (DFG, 1969; Rollins 1973) on habitat management conditions necessary for the production of these plants concluded that plant communities in Suisun Marsh are controlled primarily by the depth and duration of soil submergence and secondarily by the concentration of salts in the roots zone.

Rollins work, presented as part of the DFG testimony to the SWRCB for Decision 1485, describes the affect of soil salinity and length of soil submergence in May on seed production.

Relationship to Channel Water Salinity Standards

The protective water quality standards established in Decision 1485 are based on research by Mall (1969) and Rollins (1973), who investigated the salinity tolerance of alkali bulrush and other important waterfowl food plants in the Suisun Marsh. The SWRCB used DFG's recommendations as the basis for salinity objectives and developed the Suisun Marsh salinity

standards in Decision 1485. Included in the 1978 Board Order implementing D-1485, the State Board stated "For protection of SWRCB, permitees shall….maintain Suisun Marsh primarily as a brackish water marsh capable of producing high-quality feed and habitat conditions for waterfowl and other marsh related wildlife using best practical management practices" (SWRCB, 1978, D-1485).

Suisun Marsh Water Quality Objectives

Decision 1485 established salinity standards throughout the Marsh for the October through May "control period". Although these standards varied throughout the control season, the SWRCB did not include an east-west or north-south gradient in the standards, as is naturally occurring in the Marsh. The Suisun Marsh Salinity Control Gates have been operated since 1998 to meet the water quality standards in the Suisun Marsh.
In 1995, the SWRCB released Order 96-5 which significantly increased Delta outflow over the Delta outflow requirements of D-1485. This resulted in lower salinity in Suisun Marsh channels than under D1485. Hydrodynamic modeling conducted by DWR using the 1995 WQCP outflow objectives and operation of the SMSCG showed that the standards would likely be exceeded at stations S-35 and S-97 during dry and critical dry years.

As part of Order 96-5, the Suisun Ecological Workgroup was tasked to address the narrative standard as well as the relevancy of the existing numeric standards. The final SEW report includes recommendations specific to each of the resources addressed by the subcommittees. (SEW, 2001)

During SWRCB water rights hearing process prior to D-1641, separate presentations were made by the Department of the Interior agencies (BOR, FWS) and the remaining SMPA agencies (DWR, DFG, and SRCD). The SMPA agencies (minus BOR) requested that the SWRCB adopt Amendment Three as providing "equal or better protection" to protect the beneficial uses in Suisun Marsh. The DOI presentation focused on the validity of the standards and the narrative standards.

On December 29, 1999, the SWRCB adopted Decision 1641. This Decision implements flow objectives for the Bay-Delta Estuary, approves a petition to change points of diversion of the Central Valley Project and the State Water Project in the Southern Delta, and approves a petition to change places of use and purposes of use of the Central Valley Project.

<u>Standards and Monitoring Network</u>

D-1641 water quality objectives for Suisun Marsh are shown in **Table III-1**. Specific to Suisun Marsh, D-1641 changed S-97 in the northwestern marsh from a compliance station to a monitoring station. Data on salinity and tide stage are collected from a network of compliance and monitoring stations in Suisun Marsh channels. Currently, there are four compliance stations in the Marsh (C-2, S-64, S-49, and S-21) that collect specific conductance data mandated by D1641 and the 1995 and 1998 Water Quality Control Plans. A network of monitoring and compliance stations were established throughout the Marsh and are shown in **Figure X**.

Table III-1. Suisun Marsh Water Quality Objectives

(From D –1641 Table 3 - Water Quality Objectives for Fish and Wildlife Beneficial Uses)

Compliance Station		Time Period	Water Year Type	Parameter EC (mmhos/cm) [1]
	Eastern Suisun Marsh Salinity			
Sacramento River at Collinsville Montezuma Slough at National Steel Montezuma Slough near Beldons Landing	C-2 S-64 S-49	October November-December January February-March April-May	All	19.0 15.5 12.5 8.0 11.0
	Western Suisun Marsh Salinity			
Chadbourne Slough at Sunrise Club Suisun Slough, 300 ft south of Volanti Club	S-21 S-42	October November-December January February-March April-May	All but Deficiency Period [2]	19.0 15.5 12.5 8.0 11.0
		October November December-March April May	Deficiency Period [2]	19.0 16.5 15.6 14.0 12.5

1 The maximum monthly average of both daily high tide EC values (mmhos/cm) or demonstrate that equivalent or better protection will be provided at the location.

2 Deficiency period is: 1) the second consecutive dry water year following a critical year; 2) a dry water year following a year in which the Sacramento River Index was less than 11.35 MAF; or 3) a critical water year following a dry or critical water year. The determination of a deficiency period is made using the prior year's final Water Year Type determination and a forecast of the current year's Water Year Type; and remains in effect until a subsequent water year is other than a dry or Critical water year as announced on May 31 by DWR and USBR as the final water year determination.

Consistency with Water Rights Decision 1641

DWR and BOR are required to meet SWQCB standards (D-1641) in the Suisun Marsh during the October through May "control season". Until such time as these standards are modified, implementation of the actions described in this plan must consider DWR and BOR responsibility

and need to maintain the ability to meet SWRCB standards. Suisun Marsh Charter agencies will address and may recommend new Suisun Marsh water quality standards at the next SWRCB Water Rights Hearings.

SMSCG Operations

The SMSCG are operated by DWR, only to meet the SWRCB water quality standards which are in effect during the October through May control season. During the past several years however, the Gates have been operated from late September through mid November as part of the Adult Salmon Migration Studies conducted by DFG and DWR.

NEIGHBORING RESTORATION ACTIVITIES

Restoring and managing the Marsh requires a flexible management framework that can respond to new information and changing conditions. Adaptive management provides such flexibility and opportunities for enhancing our understanding of the ecosystem. The key to successful adaptive management is learning from all restoration actions. Subsequent restoration actions can then be revised or redesigned to be more effective or instructive. In an adaptive management process, learning must be continuous so that ecological restoration continuously evolves as the ecosystem responds to management actions allowing these actions to be revised in light of new information.

Below is a list of neighboring restoration activities whose results will be reviewed periodically for relevance to planned restoration actions. Within Suisun Marsh there are other restoration projects not associated with this Plan that will also affect the Marsh ecosystem.

Montezuma Wetlands

The Montezuma Wetlands Project includes the beneficial use of dredge disposal to restore 1,782 acres of tidal wetlands and create 48 acres of diked managed marsh on a site near Collinsville, in the eastern Marsh. An estimated 17 million cubic yards of dredged materials from San Francisco Bay would be placed on the site to raise the site's elevations to those capable of supporting marsh vegetation. The project would be constructed in four phases to minimize temporary losses of wetlands during construction and to facilitate engineered placement of the dredged material. The project also includes a re-handling facility, which would be used to dry sediments for both on-site use in levee construction and for off-site sales. Public access facilities would be constructed at two locations. The construction of each subsequent phase would be contingent upon the project meeting various engineering and ecological criteria for the previous phase. Grading of initial containment cells began in late summer 2001. Construction started on the off-handling facilities in Spring 2002.

Contra Costa Shoreline

Due to extensive urban and industrial development, few opportunities for tidal restoration exist on the Contra Costa shoreline. The FWS Administrative Draft Recovery Plan calls for protection and enhancement of existing tidal marshes in this area.

Protero Hills Landfill

Solano County Garbage Company was required to mitigate for wetland loss of 1.4 acres from road construction in 1985. Mitigation adjacent to the landfill includes restoring hydrologic and elevation conditions suitable for establishment of 2.8 acres of tidal marsh. East of this site, habitat value was increased for listed vernal pool plant and invertebrates. With the implementation of the mitigation plan, wetland acreage will total 15.6 acres.

Venoco 3D Seismic

Venoco, Inc. is conducting a short-term geophysical survey for natural gas in Suisun Marsh. Small explosive charges are buried in the ground as the energy source for recording seismic data. To minimize adverse effects to listed species, Venoco will restore 135 acres of diked wetlands or uplands to a tidal marsh ecosystem.

Beldons Landing

As mitigation for developing a boat launch facility adjacent to the Beldons Landing Bridge, DFG and Solano County are required to restore 3 acres of tidal wetlands on the site. Construction of the boat launch began in Fall 2001 and was completed in Spring 2002.

Mothball Fleet Restoration

Approximately 10 years ago, 60 acres of DFG's Goodyear Slough Unit was converted from managed wetland to "dampened tidal" (**Figure X**). This was done by the Federal Maritime Administration for expanding the road out to the Mothball fleet. The restoration involved removing two water controls and grading back to the levee banks in the location of the water controls. Very little levee was actually removed.

Proposed CALTRANS Restoration

As mitigation for impacts at the Benicia Bridge widening, CalTrans has acquired 22 acres in the Industrial Park west of the tracks and west of DFG property (**Figure X**). CALTRANS plans to dig channels and return the parcel to tidal action. This project may include digging a ditch through the 240-acre pond at DFG's Goodyear Slough Unit to feed tidal water to the 22-acre restoration site. When CalTrans constructs the ditch to convert the 240 acres to tidal, there may be an opportunity for additional tidal restoration in this area.

OUTSIDE CONSTRAINTS

A large and diverse ecosystem like Suisun Marsh is extremely complex. There are many processes and relationships at work in the ecosystem which result in many difficulties and uncertainties associated with any program to improve ecosystem health. Those processes and relationships that are beyond the control of this Plan are termed outside constraints. The following topics are examples of some of the outside constraints that have been identified which could have an impact in the Marsh.

Environmental Water Account (EWA) Water

An essential goal of the CALFED Program is to provide increased water supply reliability to water users while assuring the availability of sufficient water to meet fishery protection and restoration/recovery needs as part of the overall Ecosystem Restoration Program. Banking of EWA water south of the Delta should have the highest priority in importance, in that it creates assets which are both durable and which may be released without the ability to move water from the Delta being an issue.

Global Warming

GLOBAL WARMING
When gases in the earth's atmosphere trap radiation from the sun to maintain the warm surface temperature of earth, it is known as the "greenhouse effect". The accumulation of carbon dioxide, methane and nitrous oxide in the atmosphere caused by the burning of fossil fuels enhances the greenhouse effect which leads to global warming.

Global warming has and will continue to cause ocean water levels to rise. During the last century, worldwide sea level has risen four to ten inches. Coastal engineers estimate that a one-foot rise in world sea level will cause beaches to erode two to four feet along the California coast. As the outer boundaries of coastal wetlands erode, new wetlands will form inland as dry areas are flooded. Because marshes need to collect sediment and produce peat in order to rise, growth of new wetlands may not be able to keep up with rising water and many existing wetlands may be lost. Furthermore, urbanization of some areas adjacent to the Suisun marsh prevents inlands encroachment of the Marsh. More extreme flood events caused by an increase in rainfall and by reduced coastal drainage and high water tables will lower salinity in winter.

Sea Level Rise

Change in global sea level has been gradual and relatively constant over the past 5,000 years. In the last 100 years, however, tide gauge measurements have shown that the world's oceans and San Francisco Bay have been rising an average of 0.05 inches per year.

The most significant biological problem for the Suisun Marsh managed wetlands will be the increase in salinity of the water used for wetland management. Salt water intrusion will require additional structures and diversion canals to move fresh water from farther upstream into the Marsh. Pumps will be required to drain many of the duck clubs as sea level rises. Too, the outboard levees could be subject to overtopping from high water.

Snow Pack Change / Hydrologic Change

Global warming has already led to earlier runoff from the Sierra Nevada, warmer winters and springs, and possibly more severe flooding on the American River. Eventually, snow packs may become much smaller, reducing runoff further.

Salinity Change

[WRITE-UP MISSING – TERRI TO PROVIDE]

Gas Well Drilling

The silt and sand deposited during the youth of the Suisun Marsh trapped large quantities of high quality natural gas. Gas extraction has occurred in the Suisun Marsh since the gas fields were discovered 1938. Permits have been issued for gas extraction in Suisun Marsh nearly every year since 1967. Some of these wells went into production and some did not. At least six natural gas well sites are in production today. When natural gas prices rose in 2000 and 2001, interest in natural gas exploration increased in Suisun. There was one exploratory well drilled, but it did not hit commercial quantities of gas. There are also 4 applications for drilling exploratory wells. The permits are expected to be completed in time for the gas companies to drill in the summer of 2002. In July of 1999, Venoco, Inc. and Occidental Resources of California, LLC were issued a permit allowing them to conduct a 41,600 acre seismic survey for natural gas. The first phase of the project was completed this year and the second phase will commence in the spring of 2002. If the companies find that there is a potential for production of natural gas, there may be a flush of drilling applications making their way through the permitting system in the near future.

Urban Encroachment

In the last 30 years, the population in the San Francisco Bay Area has grown at an alarming rate. Solano County is the ninth-fastest growing county in California and accounts for 32% of the population growth among the nine Bay Area counties. The Suisun Marsh rests in the heart of Solano County. In 1977, the State of California Legislature enacted a law, the Suisun Marsh Preservation Act, and policies in the Suisun Marsh Protection Plan to protect the Marsh from development. However, land surrounding the Marsh has been overlaid with industrial, commercial, and residential development right up to the Suisun Marsh boundaries.

The City of Fairfield borders the northwest corner of Suisun Marsh. The population of Fairfield in 1970 was 44,146 people (prior to the enactment Suisun Marsh Preservation Act). In 1971, the land that surrounds the northwest corner of the Marsh was incorporated into the City of Fairfield. This addition contributed to the increasing population of Fairfield, resulting in 95,327 people present in 2000. Today, an average of 535 residential units and 13 acres of industrial and commercial land is developed every year. Industrial, commercial, and residential development in Fairfield has pushed right up to the boarders of the Suisun Marsh. If the Marsh had not been protected, the City of Fairfield most likely would have developed over upland buffer and sensitive marsh habitat with subdivisions and commercial developments.

The Suisun Marsh, however, is not completely immune to development. Suisun City borders the northern boundary of the Marsh. In 1982, the Suisun Marsh Preservation Act was amended to remove part of Lawler Ranch from the area of Suisun Marsh to allow for development. The area was then incorporated into Suisun City. This 550-acre area is mostly zoned for residential development, but 20 acres adjacent to Grizzly Island Road is zoned for commercial use. Today this area is developed with residential housing, two fast-food restaurants, a gas station, and the rest of the commercial area will most likely be developed in the near future.

The impact of urban development reaches far beyond the direct loss of habitat. Urban development also causes secondary impacts to the surrounding environment and wildlife.

Urbanization causes increases in the volume of runoff that flows to adjacent wild habitats. The result is an increase in turbidity, sedimentation, and flooding. Runoff from urban areas often contains oils, pesticides and nutrients that diminish water quality in downstream habitats. These adjacent habitats also suffer from air pollution and accumulation of litter.

Urban development also has negative impacts on wildlife. Urban structures break apart contiguous habitats, resulting in altered migration, movement patterns, and genetically isolated populations. Light, noise, and the movement of people and vehicles alter wildlife behavior. Such disturbances cause wildlife to stop feeding and abandon nests and young, resulting in decreased energy intake and reproductive success. Urbanization also increases the abundance of those predator species and invasive species that thrive in urban areas such as the Striped Skunk (*Mephitis mephitis*), Common Raccoon (*Procyon lortor*), Virginia Opossum (*Didelphis virginiana*), European Starling (*Sturnus vulgaris*), and the Domestic Cat (*Felis catus*). These animals reduce the populations of wildlife near urban areas either directly by feeding on adults and eggs or indirectly by displacing them from nesting habitat and spreading disease.

Proposed HWY 680/80 Bypass Through Suisun Marsh

For the past few years traffic congestion along the I-680/I-80/Highway 12 interchange has gotten increasingly worse. In 2000, the Solano Transportation Authority began to propose solutions to solve the problem. They conducted project scoping meetings and asked for comments from the public. As a result, many different solutions were proposed and narrowed down to a small number that will be studied.

The proposed solution that is of greatest concern for the Suisun Marsh is the South Parkway. The South Parkway would run through the protected area of the northwest corner of the Suisun Marsh. The proposed roadway could stretch from Gold Hill Road on Highway 680 to Highway 12 in the City of Fairfield. Many proposed alignments have been discussed and all of them would infringe on the protected area of the Marsh and would result in a loss of wetlands. The alignment with the least impact would cut around the town of Cordelia, resulting in a loss of 11 acres of wetland habitat and 30 acres of upland habitat in Suisun Marsh. The alignment with Red Top Road would result in the loss of 13 acres of wetland habitat and 25 acres of upland habitat. The alignment with Gold Hill Road would result in the loss of 16 acres of wetland habitat and 27 acres of upland habitat. The Solano Transportation Authority may also study a viaduct that would run along the Union Pacific Railroad right-of-way from Benecia to the City of Fairfield. All South Parkway alternatives would result in a direct loss of wetlands and would have secondary impacts to wildlife and their habitats due to disturbance and fragmentation of habitat.

It is very possible that the South Parkway proposal will be dropped once the severity of the environmental impact is realized. The environmental studies that include the South Parkway are expected to be completed by 2006.

Petroleum Product Transmission Pipelines in Suisun Marsh

There are numerous pipelines that exist under the surface of Suisun Marsh. There are three primary pipeline systems we are aware of in different locations in the Marsh. The first is a petroleum product pipeline that runs from Concord to Sacramento. This pipeline is aligned with the Union Pacific Railroad on the western side of Suisun Marsh and runs under about 14 miles of marsh habitat. The pipeline is 40 years old and it no longer has the capacity to carry the volume of petroleum products needed today. Although there have not been any petroleum leaks in the Marsh, the pipeline has leaked at other locations in Solano County. The pipeline is also a potential hazard because of exposed crossings over 4 sloughs in the Suisun Marsh. There is a proposal to replace this old pipeline with a new pipeline in 2004. The new pipeline would start at Concord, would run north along the Interstate 680, cut through the northwest corner of Suisun Marsh from Gold Hill Road up to Highway 12, then continue to run north to Sacramento. The new proposed pipeline alignment decreases the potential risk of petroleum spills in the Marsh because it will be buried under all water crossings at a depth of 30 feet below the surface. The new alignment will also reduce the length of the pipeline that crosses marsh habitat by about 12.5 miles.

The second petroleum pipeline carries jet fuel and runs along the Union Pacific Railroad, along Highway 12 on the north side of Suisun Marsh, then up to Travis Air Force Base. When Highway 12 was widened, the pipeline had to be moved and is currently aligned parallel to Laurel Creek near the Hill Slough Wildlife Area. The third set of pipelines are small natural gas transmission lines that carry natural gas from existing production wells in the Marsh to higher capacity delivery pipelines. These pipelines cross Honker Bay near Chipps Island, and are at various locations on Van Sickle Island, Wheeler Island, Grizzly Island and Miens Landing.

IV. Problem Statement

During consultation on the proposal to modify the SMPA with Amendment 3 and the regional general permit, agencies disagreed over the protection of existing habitat values and the needs of threatened and endangered species in the Marsh. Amendment Three of the SMPA and the Regional General Permit originally proposed to maintain and authorize management practices which FWS believed would perpetuate the existing decline of the Marsh's threatened and endangered species. In addition, the release of a draft CALFED Suisun Marsh Levee Investigation Report, and discussion over Suisun Marsh water quality standards at water rights hearings identified other disagreements over resource needs and agency decisions pertaining to Suisun Marsh.

SUISUN MARSH PRESERVATION AGREEMENT BACKGROUND

DWR, DFG, BOR, SRCD signed the Suisun Marsh Preservation Agreement on March 2, 1987 to resolve conflicts between Marsh landowners and the BOR and DWR. The SMPA was developed to provide and fund facilities or activities to mitigate impacts of reduced Delta outflow caused by SWP and CVP operations and benefit the Marsh landowners. Implementation of the Suisun Marsh Preservation Agreement also enabled DWR and BOR to meet conditions of Decision 1485 required by the SWRCB.

The objectives of the SMPA are:

- To assure that BOR and DWR maintain a water supply of adequate quantity and quality for managed wetlands within the Marsh. This is to mitigate adverse effects on these wetlands from the CVP and SWP, and a portion of the adverse effects from other upstream diversions.
- To improve Marsh wildlife habitat on managed wetlands.
- To define the obligations of BOR and DWR necessary to assure the water supply, distribution, management facilities, and actions necessary to accomplish these objectives.
- To recognize that water users in the Marsh (i.e. existing landowners) divert water for wildlife habitat management within the Marsh.

These objectives were developed through negotiations among the parties of the SMPA. To meet these objectives, the original SMPA established channel water salinity standards and a process for scheduling construction of large-scale facilities in Suisun Marsh that would enable the salinity standards to be met. BOR and DWR had the responsibility for constructing the facilities and for meeting the salinity standards. Construction of the facilities was to be in phases, based on evaluation of need and effectiveness of the facility previously constructed. The Initial Facilities, Lower Joice, Cygnus, and the Suisun Marsh Salinity Control Structure were constructed. Environmental planning had begun for the Western Suisun Marsh Salinity Control Project, Phases III and IV of the SMPA.

Decision to Amend the Suisun Marsh Preservation Agreement

In 1995, the four parties to the SMPA agreed that the additional large-scale facilities described in the Plan of Protection and the SMPA were not necessary for salinity control in Suisun Marsh. This decision was based on changed conditions resulting from effective operation of the Suisun Marsh Salinity Control Gates and increased Delta outflows under the 1995 Water Quality Control Plan. Instead, the parties developed and negotiated SMPA Amendment Three, which focused on improving management on private lands.

The SMPA was previously amended on two occasions. The first amendment was signed in 1988 and resulted in changes in the S-21 monitoring station location, and in the construction schedule for the Cygnus and Lower Joice Island facilities. The second amendment was signed in 1994 and resulted in a change in the Individual Ownership Cost Share Program (Article 7) from a 50 percent to a 75 percent cost-share reimbursement by DWR and BOR to the landowners.

Based on analysis of several years of hydrodynamic and salinity modeling and water quality data collected in the Suisun Marsh, DWR and BOR concluded that SWP/CVP operations and other diversions upstream of Chipps Island have not significantly affected flow or water quality patterns in creeks north and west of Suisun Marsh (DWR 1994a). However, urbanization and land development north and west of the Marsh do significantly affect the pattern of creek inflow, sediment, and water quality entering the Marsh. Also, data collected from private and public managed wetlands indicate that water management plays a pivotal role in achieving soil water salinity and habitat goals (DWR Data Summary Reports 1992-1994). In addition, a prolonged drought, such as the one in 1987 through 1992, was not contemplated when the Deficiency Standards (allowing higher salinity) were included in the original SMPA. Thus, the original SMPA does not adequately address impacts to managed wetlands under drought conditions.

The decision was made to amend the SMPA, because of the reasons listed above, and because hydrologic conditions in Suisun Marsh have changed since the original SMPA was signed in 1987. The Amendment would make the channel water salinity standards consistent with the SWRCB's 1995 Water Quality Control Plan, and replace additional large-scale facilities with water and land management activities to meet the objectives of the SMPA in the western Marsh. Amendment Three requires amending the Monitoring Agreement to include monitoring required by the new actions and to include SRCD as a participant in the monitoring program. It also requires amending the companion Mitigation Agreement to broaden remaining mitigation activities and funds to include restoration of tidal wetlands and multi-species management.

During the Amendment Three negotiations, the SMPA agencies considered and evaluated several actions for inclusion in the Agreement. Those actions ultimately included were done so because the SMPA agencies believed they could be easily and expeditiously implemented under the existing regional general permit. The Amendment Three actions are described in detail and included as **Appendix X**.

Joint Consultation

The SMPA agencies began informal consultation with the FWS in 1998 and entered into formal consultation in 1999. The SMPA agencies, the FWS, and the COE agreed that a joint consultation for Amendment Three and the SRCD regional general permit renewal would be the most expeditious way to address the issues. **[note: this needs clarification, e.g., because some terms could be incorporated in the permit? Or: because the issues would affect the permit also? Or?]**

Through this consultation, several issues arose, including the need to look at an ecosystem approach to managing Suisun Marsh resources.

Compliance Issues and ECAT

Also during this consultation, the SMPA agencies became aware of FWS concerns over compliance with terms and conditions of existing biological opinions. The Suisun Marsh Preservation Agreement Environmental Coordination Advisory Team (ECAT) was established in 1998 to address and resolve compliance issues. This group, comprised of SMPA agencies, FWS and Corps of Engineers staff, has been meeting regularly (monthly or bi-monthly) since its inception to meet SMPA mitigation obligations, develop and implement monitoring programs for sensitive wildlife species, and evaluate potential properties for restoration.

Specific SMPA compliance issues and their resolution are presented below.

<u>Vegetation Monitoring</u>

Vegetation monitoring called for in the 1981 biological opinion and described in the 1987 Suisun Marsh Monitoring Agreement was envisioned to determine if a change in vegetation was occurring in the Suisun Marsh due to management actions on seasonal wetlands. Aerial photos were taken every three years, as called for in the Monitoring Plan. However, the agencies could not agree on an evaluation methodology.

In 1998, a new protocol for vegetation monitoring was developed and conducted by DFG's Wildlife Habitat and Data Analysis Branch (WHDAB). This protocol blends ground-based classification, aerial photo interpretation, and GIS editing and processing. The method is based on the development of a quantitative vegetation classification, which is used to describe the vegetation map units of the marsh.

A final report was completed in December 2000 using this new protocol. Change detection analysis was also conducted in 2001 and showed insignificant vegetation change from the year before. Future change detection analysis will be conducted as needed. Intervals will be determined by the WHDAB and ECAT.

Salt Marsh Harvest Mouse Conservation Areas

The acreage requirements of the FWS 1981 BO for the Plan of Protection are as follows:

- 2,500 acres of preferred salt marsh harvest mouse habitat (pickleweed) in the marsh, including 1,000 acres set aside and managed as salt marsh harvest mouse Conservation Areas

- 100 acres of salt marsh harvest mouse habitat created as mitigation for construction of the Initial Facilities described in the Plan of Protection

The 1981 BO required that 1,000 acres of land be managed by DFG on behalf of the SMPA agencies as preferred salt marsh harvest mouse habitat. In 1987, seven areas totaling 1,130 acres were set aside as salt marsh harvest mouse Conservation Areas **(Table IV-1)**. These areas are Benicia, Hill Slough West Pond 4, Hill Slough East Area 8, Joice Island, Crescent, Pond 15, and Pond 1**.** Benicia, Hill Slough West Pond 4, and Crescent already had well-established stands of pickleweed; Hill Slough East Area 8 and Joice Island were tidal areas with small stands of pickleweed-dominated vegetation; and Pond 15 and Pond 1 were upland areas that were excavated to create salt marsh harvest mouse habitat. Except for the two tidal areas, all are managed to maintain salt marsh harvest mouse habitat.

One goal of the Conservation Measures in the 1981 BO was to retain at least 2,500 acres of preferred salt marsh harvest mouse habitat (pickleweed) adequately distributed throughout the marsh. The SMPA agencies interpreted this to mean that any existing preferred salt marsh harvest mouse habitat, regardless of its ownership or management, contributed to the 2,500-acre goal. However, the FWS intention was that the 2,500 acres would be set aside as Conservation Areas owned and managed by DFG.

To resolve past compliance issues, the SMPA agencies have agreed to restore 300 acres of tidal marsh. This 300 acres will bring the total of salt marsh harvest mouse conservation acreage up to 2500 acres.

In 1999, DFG proposed seven new Conservation Areas totaling 3,050 acres, and the FWS accepted one of these areas, Peytonia Slough, as a Conservation Area. In 2001 three other proposed areas, Hill Slough West Ponds 1 & 2, Hill Slough West Pond 4A, and Hill Slough East Area 9, were accepted. The current total of the eleven Conservation Areas is 2,201 acres.

Table IV-1. Department of Fish and Game Lands Managed as Salt Marsh Harvest Mouse Habitat in Suisun Marsh

Location	Acres	Year Established	Area of Marsh	Wetland Type
Benicia	46	1987	southwest	managed
Hill Slough West Pond 4	71	1987	north-central	managed
Hill Slough East Area 8	216	1987	northeast	Tidal
Joice Island	271	1987	central	Tidal
Crescent	67	1987	central	managed
Pond 15	357	1987	central	managed
Pond 1	102	1987	southeast	managed
Subtotal	**1130**			
Peytonia Slough	253	1999	northwest	muted tidal
Hill Sl. West Pond 4A	87	2001	north central	managed
Hill Sl. East Area 9	527	2001	northeast	Tidal
Hill Sl. West Pond 1 & 2	204	2001	north-central	managed
Grand Total	**2201**			

Island Slough Wetland Development Area

The 1981 BO required the development of 340 acres of wetland to mitigate for losses due to construction of the Initial Facilities described in the Plan of Protection. Difficulties in obtaining the environmental permits delayed the construction of this mitigation area until 1996.

Of these 340 acres, 100 acres of habitat were to be created and managed for the salt marsh harvest mouse. A 525-acre parcel on Island Slough was purchased to meet these and other mitigation obligations. One hundred acres of the parcel is being developed as harvest mouse habitat.

In 1999, a 57-acre parcel at Island Slough was developed as harvest mouse habitat as mitigation for loss of salt marsh harvest mouse habitat when the Morrow Island Distribution System was dredged in 1997.

REGIONAL GENERAL PERMIT RENEWAL

[STEVE WRITING?]

CALFED SUISUN MARSH LEVEE INVESTIGATION

As a result of flooding in Suisun Marsh in 1998, DWR conducted hydrodynamic modeling to look at water quality impacts of catastrophic levee failures. The modeling results identified critical links between Suisun levees and Bay/Delta water quality protection. The CALFED Bay-Delta program established the Suisun Marsh Levee Investigation Team (SMLIT) in 1998 to gather information on the costs and benefits of including Suisun Marsh levees in the CALFED program, especially as they relate to CALFED Water Quality, Water Supply Reliability, and Ecosystem Restoration Program (ERP) goals.

FWS was concerned that implementation of the proposed Marsh levee program would preclude needed tidal restoration and endangered species recovery.

ENDANGERED SPECIES RECOVERY

The FWS *Administrative Draft Recovery Plan for Tidal Marsh Ecosystems* calls for 20,000-25,000 acres of restored tidal marsh over the course of approximately 50 years in Suisun to promote recovery of endangered species. Implementation of recovery actions is expected to be constrained by land elevations, possible lack of available funds for property acquisition and restoration actions, and the lack of willing sellers. This goal is in conflict with existing land use (waterfowl habitat management) in the Marsh. Restoring sufficient acreage of diked wetlands and uplands tidal marsh to recover threatened and endangered species will reduce significantly the amount of waterfowl habitat in Suisun Marsh.

WATER QUALITY OBJECTIVES

As a condition of CVP and SWP operations, the SWRCB water rights decisions require that BOR and DWR meet salinity standards in Suisun Marsh during the October through May "control season". Although these standards vary throughout the control season, they do not take into account east-west or north-south gradient or allow for inter-annual variability. The FWS believes that this lack of variability is a problem for some of Suisun's tidal marsh plants that need periodic high salinity to allow them to colonize areas of vegetative dieback.

In 1996, the Suisun Ecological Workgroup was tasked to address the narrative standard as well as the relevancy of the existing numeric standards. The final SEW report includes recommendations specific to each of the resources addressed by the subcommittees because the subcommittees could not reach agreement on salinity objectives in Suisun. (SEW, 2001)

V. Implementation Process

The CALFED Program and the CALFED Agencies are approaching the ecosystem and water management issues from a regional perspective. Although each region raises unique ecosystem and water management issues, each region's issues affect the health and function of the Bay-Delta system as a whole. CALFED has enlisted the Suisun Marsh Charter Agencies to develop a durable regional plan for the Suisun Marsh, and to define the process that will be followed to implement the Plan. The Charter Agencies will rely on local leaders and organization to provide advice and support for implementing the projects in the Suisun Marsh.

A Charter Implementation Team will be established to implement this Plan. Their responsibilities will include review and oversight of projects proposed in Suisun Marsh. Each Charter agency will be represented on this team.

Any Charter agency may assume lead responsibility for any specific project implemented under the Plan. A Technical Advisory Committee consisting of Charter Agency representatives, project proponents and/or interested parties shall be established to review and contribute to specific project implementation.

In addition, several groups currently exist that could assist in implementation of projects in the Marsh. The existing SMPA ECAT group already has a process in place for evaluating potential properties for acquisition. This group also focuses on mitigation monitoring. The Suisun Marsh Technical Team (formally the CALFED Levee Team) will be utilized for technical review of proposed levee projects. Suitable science advisors available through the CALFED Science Program will be sought. Other groups which may assist in implementation include, but are not limited to, USGS Biological Research Division, Central Valley Habitat Joint Venture, Ducks Unlimited and California Waterfowl Association.

GUIDING PRINCIPLES

The Suisun Marsh Charter agencies agreed, in the spirit of CALFED, to follow the guiding principles below, which were used in the development and will be used in implementation of this Plan.

a. The primary goal of the Charter process is to find solutions that meet the needs of waterfowl hunting heritage, existing wildlife values, water quality and endangered species recovery.

b. Conversion of public and private managed wetlands to other uses or management strategies will be carried out only with willing sellers and cooperators.

c. Third party impacts of Implementation Plan projects will be addressed and compensated as appropriate.

d. Meeting the Plan objectives will require pilot projects and adaptive management.

e. The Implementation Plan recognizes the range of response time-scales associated with implementation actions. Benefits to the protection of existing wildlife values could be realized as soon as institutional arrangements are made. Conversely, restoration and enhancement will occur at variable rates, depending on local factors including availability of suitable properties and existing physical and biogeochemical conditions.

f. Restoration actions should establish conditions that will move as rapidly as possible to dynamic, self-sustaining function. Project design will take into account physical and biological processes, monitoring and adaptive management.

g. Implementation actions are opportunities for scientific assessment. The value of meeting primary needs is equaled by the value in advancing restoration science toward meeting those needs.

h. The mitigation measures set out in the CALFED ROD will be used during project-specific planning where appropriate.

i. Projects will use science-based adaptive management. This approach will rely on constant monitoring and evaluation of actions.

KEY STEPS IN DEVELOPING PROJECTS

The key steps in developing specific projects are:

1. Development of Clear Restoration Goals – Clear restoration goals and tangible, measurable objectives will be developed to provide direction to restoration efforts and to measure progress toward the desired restoration goal. Objectives must be tangible and measurable so progress toward achieving them can be clearly assessed.

2. Development of Conceptual Models – Restoration or rehabilitation programs for complex ecosystems such as Suisun Marsh will be based on clear concepts about how the system is believed to function, how it has been altered, and how various actions might improve conditions in the system. Conceptual models provide a basis for quantitative modeling or identify critical information needs for research or monitoring. Conceptual models can be used to link management actions to outcomes, for highlighting key uncertainties where research or adaptive probing might be necessary, and identifying monitoring needs.

3. Development of Hypotheses – Testable hypotheses will be developed for proposed actions. The hypotheses should be tested through experiments using the conceptual models and on-the-ground research. The results from these experiments then feed back into the adaptive management process and will support proposed actions, suggest revisions to actions, and identify needs for further research.

4. Staged Implementation – A staged implementation program will be developed that entails:
   - Short-term implementation of projects;
   - coordinated monitoring, evaluation, and reporting of the results; and
   - adaptive management for each action, including pragmatic adjustments to targets and techniques.

5. Environmental Compliance – **[Lee will rewrite, combining 2nd & 3rd paragraphs and keeping 3rd]** The MSCS features a two-tiered approach to FESA, CESA, and NCCP compliance that corresponds to CALFED's two-tiered approach to compliance with the National Environmental Policy Act (NEPA) and the CEQA. To complement the second-tier, project level environmental review of CALFED actions that is anticipated, the MSCS identifies a process for development of Action Specific Implementation Plans to be prepared for each action or groups of actions as they are proposed for implementation. ASIPs are designed to provide the information necessary to initiate project-level compliance with FESA, CESA, and NCCP.

   The Implementation Plan will develop ASIPs for specific actions in the Marsh when enough detailed information is available about the actions to analyze fully their impacts on evaluated species and habitat. ASIPs will be used as the basis for obtaining an incidental take permit pursuant to Section 2081 (b) of the California Fish and Game Code.

   FWS and NMFS will use the ASIPs to prepare action-specific biological opinions and DFG will use the ASIPs as project-specific NCCPs for evaluation and approval.

6. Monitoring Framework – A monitoring program will measure progress towards specific project or habitat objectives and test the hypotheses on which the project design was based. On a marsh-wide scale monitoring results are needed to design future tidal and microtidal wetland projects for the greatest ecological benefit. Finally, monitoring is required to document the results of the project, and to assess the overall success of implementing CALFED's ERP goals.

   The monitoring programs will accomplish the following goals: (1) document ecological processes on the site as a result of the project activities (e.g. subsidence or erosion of habitat features, water circulation patterns, water quality); and, (2) document the use or non-use of habitats by targeted species.

   Typically, a minimum of five years of post-project monitoring will be included in specific project plans. To adequately examine the ecological processes and success of the project, additional monitoring may be required.

INFORMATION MANAGEMENT SYSTEM

An information management system will be developed to facilitate communication and coordination among the many agencies and stakeholders who will be involved in carrying out the Implementation Plan. This system will to provide access to relevant data to facilitate public

involvement, scientific review, and dispute resolution. Nearly every environmental intervention offers an opportunity to document the ecosystem's prior condition and response to intervention and offers an opportunity to validate or revise hypotheses. Adaptive management also involves continual inventory, analysis, and interpretation of scientific data. An information management system will help collect, store, track and disseminate the decisions and raw data that drive the restoration program.

An information management system will help facilitate public involvement and scientific review by providing access to the information being used to evaluate or justify a proposed action, including not only results and conclusions, but also baseline information, monitoring data, models and their parameters, and assumptions. Participating stakeholders and CALFED agency personnel will be better informed, and individuals and organizations will be able to conduct their own independent analysis of data underlying proposed actions. An information management system could also be used in conjunction with a website to provide access to reports in common use within the CALFED community, including digital copies of printed reports.

An information management system will also be an important component of dispute management by providing common access to the data underlying decisions.

To provide rapid production and dissemination of information, the information management system will rely principally on electronic communication. However, the system will also accommodate the information needs of stakeholders who rely upon more traditional means of print communication. DWR will establish and manage a webpage to disseminate this information.

DISPUTE RESOLUTION

There is a long history of conflict over the Bay-Delta resources. CALFED was formed to help reduce the level of conflict in the Bay-Delta system by bringing together state and federal agencies with stakeholder groups in a collaborative planning process. Many features of the current CALFED planning process will be incorporated into the Plan to help prevent or reduce conflict during the implementation phase. For instance, involving the public in the decision-making and implementation will allow agency personnel and stakeholders to identify differences of opinion early. Independent scientific review will help resolve technical disputes, as will the adaptive management process, which can accommodate alternative hypotheses about ecosystem structure and function.

There is a need to include a dispute management strategy to address conflicts. An effective dispute management process can help pre-empt the use of litigation to settle disputes. Litigation commonly forces each side in a dispute to take an extreme position, which can intensify conflict among stakeholders. Dispute resolution provides all parties with lower risk ways of exploring more central position, and it can provide momentum for building consensus by enumerating points of agreement rather than focusing exclusively on points of contention.

Using a neutral facilitator to conduct the dispute resolution process will help to reduce conflict. Structuring a dispute resolution process less as a formal hearing and more as a professional

workshop – with briefings, discussion, and interpretation of the information at issue – will further reduce the combative nature of the dispute.

Although specific approaches to dispute resolution will be dictated by the dispute at hand, the following general guidelines will help structure the dispute resolution process:

- A formal announcement will be made that an issue is being subjected to the dispute resolution process.
- The stakeholders to be included in the process will be identified.
- A formal description and analysis of each stakeholder's position will be provided.
- All of the main decision makers will be identified and included in the process.
- The scope of the issue will be determined clearly.
- The means by which the final recommendation or decision is to be rendered (administrative decision, arbitration, consensus, majority vote, etc.) will be identified.
- Any limits, such as legislative mandates or limits on the delegation of authority, will be identified.

At the conclusion of the dispute resolution process, participants will compile a report identifying points of agreement, remaining points of contention, and an agenda for resolving the remaining issues.

VI. Integrated Implementation

Placeholder for Steve Chappell's write-up

VII. Strategies for Ecosystem Management

Listed below are proposed strategies for ecosystem management to meet the needs of existing habitat values, endangered species recovery, water quality protection, and invasive species control.

DIKED SEASONAL WETLANDS MANAGEMENT

The majority of existing wildlife habitat in Suisun Marsh is found in diked seasonal wetlands. Therefore the need to protect and enhance existing values is recognized and will be integrated with other Plan actions.

Enhancing Existing Diked Wetlands

Enhancement of existing wetlands can be improved though increased funding for management activities. The types of work could include construction of new and the cleaning of existing ditches, levee construction and maintenance, contouring of pond bottoms, maintenance and upgrading of water control facilities (including pumps), and vegetative plantings and invasive species control.

Maintenance of Existing Diked Wetlands RGP (Stable Regulatory Climate)

SRCD Administration of the Regional General Permit:

SMPA Amendment Three Actions

In lieu constructing large-scale facilities, the SMPA parties identified supplemental actions consistent with the original SMPA to improve water management and wildlife habitat on managed wetlands in the Suisun Marsh. The actions were ultimately selected because they were authorized under the existing RGP and thought to be easily implementable. The Amendment Three Actions include:

- Making channel water salinity standards consistent with the 1995 Water Quality Control Plan, promulgated by the California State Water Resources Control Board;
- Changing the status of two salinity compliance stations to monitoring stations;
- Establishing a Managed Wetlands Improvement Fund to reimburse private property owners for 75% of the costs to operate pumps, maintain levees, and raise pond bottoms; and for 50% of the costs to improve discharge facilities such as culverts, pipes, gates and pumps;
- Establishing a Drought Response fund that reimburses private property owners for selected drainage improvement activities;

- Constructing fish screens on water diversions throughout the Marsh, including fish screens at Morrow Island Distribution System;

- Maintaining existing water facilities, including the Lower Joice Island Unit fish screens, turnouts on the Roaring River Distribution System, and Goodyear Slough outfall;

- Updating Individual Ownership Adaptive Management Habitat Plans, most of which were written over 20 years ago;

- Administering a Joint-Use Facility Program to fund 100% of maintenance activities on structures and facilities shared by two or more landowners;

- Implementing a Water Manager Program administered by SRCD, which will employ a biologist part time; and

- Using screened portable drainage and diversion pumps throughout the Marsh to improve water delivery and drainage in managed wetlands.

Dredging for Levee Maintenance and Drainage Capability

[MISSING TEXT]

MICROTIDAL WETLAND WATERFOWL MANAGEMENT

Waterfowl-priority diked marshes can be re-engineered to increase compatibility with sensitive tidal marsh-dependent species by converting many managed non-tidal waterfowl marshes to microtidal wetland systems including shallow ponds and brackish marsh with high pickleweed marsh edges.

Benefits to Waterfowl

The basic purpose of engineering shallow microtidal wetland ponds is to improve the shallow water foraging, roosting, and nesting habitat for shorebirds, wading birds, and waterfowl that are provided by non-tidal shallow water habitats such as managed seasonal wetlands. A related purpose is to provide habitat that is reliable, resilient, and as self-sustaining as possible. Microtidal ponds are intended to provide equal or superior habitat to the same spectrum of avian species that utilize salt ponds and managed seasonal wetlands. An increase in the waterbird habitat quality (carrying capacity) of diked microtidal wetlands is needed to offset decreases in total shallow aquatic waterbird habitat caused by tidal restoration (Goals Project 1999).

Benefits to Estuarine Habitat

Microtidal wetlands, which supply shallow, subtidal estuarine beds of submerged aquatic vegetation should provide habitat for a wide range of native estuarine species. Connection to the

tidal cycle will allow fish to enter and exit the SAV beds; therefore, the fish should not be permanently entrained in the system. In late summer, limited circulation within portions of the microtidal impoundments could at times become conducive to local hypoxia, hypersalinity, and excessive algal growth. These adverse water quality conditions can occur in some brackish estuaries with restricted tidal flows (Kuo and Neilson 1987; Portnoy 1991). Summer hypoxia and hypersalinity can be prevented in managed microtidal conditions by adjusting tidegates during critical seasonal periods to increase tidal range, flows, and turnover of impounder waters. Hydrodynamic modelling and water quality monitoring will be utilized in project design and implementation to prevent adverse water quality conditions for fish and maintain suitable subtidal vegetatated shallows as habitat for native estuarine fish.

Minimization of Repair and Maintenance

Dikes and water control structures of traditional non-tidal waterfowl wetlands were designed for a routine maintenance program and a high degree of hydrologic isolation from tidal influence. This design requires relatively high, steep dikes and close control of water transfers. Microtidal wetlands in contrast, can be designed to relax the need for tidal isolation and the precision of water control of dike-enclosed basins, with structures which are tolerant of tidal overtopping and less prone to rapid deterioration. This resilience allows for lower, flatter-sloped dikes with dense vegetation (habitat levees) which are subject to intermittent flooding. Erosion resistance of reconstructed dikes (low-angle slopes and vegetative stabilization) should be emphasized. Unlike non-tidal waterfowl management regimes, microtidal wetlands are not likely to cause the problems of extreme hypersalinity, soil acidification, and subsidence (peat decomposition, dewatering) associated with periodic aerobic soil conditions and exclusion of tidal sedimentation.

Vegetation Objectives for Microtidal Ponds

Microtidal ponds represent a continuum of habitats with restricted tidal range, varying with the extent and distribution of emergent marsh vegetation. Ponds are predominantly open shallow aquatic habitat (often with submersed vegetation), with mostly fringing marsh vegetation. Microtidal marshes have a matrix of emergent marsh vegetation, and have inclusions of persistently flooded, unvegetated habitat (pans, ponds, channels). Intermediate types of microtidal wetlands, with variable proportions of open water and emergent marsh, may form as stages of marsh succession, or as expressions of variable topographic and hydrologic conditions. Vegetation objectives for waterbird habitat in microtidal wetlands depend on the balance between unvegetated aquatic habitat, emergent vegetative, food resources, roosting habitat, and nesting habitat.

Microtidal pond of San Francisco Bay have limited amounts of emergent vascular vegetation. The lack of periodic prolonged emergence of the lagoon bed ("drawdown") prevents significant seedling establishment of emergent vegetation, except along the narrow intertidal margins. (Daily emergence of sheltered, intertidal substrates allows salt marsh vegetation to prevail where tidal range is unrestricted.) The dominant vegetation of microtidal ponds in brackish and saline conditions is generally widgeongrass (ditchgrass, *Ruppia maritima*), a submersed aquatic plant related to pondweeds. *Ruppia* beds occur in shallowly flooded areas (about 30 centimeters/ 1 foot depth) and support abundant aquatic invertebrate communities and provide foraging habitat

for dabbling waterfowl. Similar submersed vegetation (*Potamogeton* spp.) occur in the fresh-brackish eastern reaches of the estuary. *Ruppia* establishes abundantly and spontaneously in most shallow tidal and non-tidal lagoon environments, even where late summer hypersaline or emergent conditions occur. It is readily dispersed by waterfowl and may be readily translocated by rhizome fragments or mud/rhizome plugs.

LEVEE PROGRAM

The CALFED Bay-Delta program established the Suisun Marsh Levee Investigation Team (SMLIT) in 1998 to gather information on the costs and benefits of including Suisun Marsh levees in the CALFED program, especially as they relate to CALFED Water Quality, Water Supply Reliability, and Ecosystem Restoration Program (ERP) goals. The Team used computer models to evaluate hydrodynamics and salinity impacts of controlled and uncontrolled levee breaches in the Suisun Marsh. The final Suisun Marsh Levee Investigation Team report is included as an appendix to this Plan (**Appendix XX**). It is a complete reporting of SMLIT process, the modeling approach, assumptions, results, analysis, and conclusions.

The SMLIT final report was completed as the Suisun Charter Implementation process was initiated. The Suisun Marsh Levee Investigation Team, and its successor, the Suisun Marsh Technical Support Team, agrees that implementation of the SMLIT recommendations should be carried out within the context of the Suisun Marsh Charter Implementation.

This Plan recognizes the perceived conflict between the need for levees as flood protection, and the use of levees as transition habitat within wetland ecosystems. The Suisun Marsh Levee Program (**Appendix X**) proposes to integrate the protection of water quality, endangered species, and existing wildlife uses. Levee system integrity is an essential component of the Plan. Uncontrolled flooding of existing wetlands is as detrimental to beneficial uses of Bay/Delta resources as the "hardening" of levee to serve only for flood control.

The Levee Program describes the current Suisun Marsh levee system and identifies critical links between Suisun levees and Bay/Delta water quality protection. Components of include Suisun Marsh Levee Protection Program include 1) routine maintenance 2) subventions, 3) special projects such as habitat levees, 4) emergency response. Subsidence research and beneficial reuse of dredged material are also components of the Levee Program. Incorporation of these elements into a coherent, adaptively managed levee program will provide synergistic interaction, enabling beneficial uses in addition to those associated with a more traditional implementation strategy involving only individual components.

Routine Maintenance

Routine exterior levee maintenance is required to prevent levee overtopping and failure. Typical activities include topping the crown of the levee to offset subsidence, coring to eliminate rodent burrows, and repair erosion damage. Prior to 1995 dredging from tidal sloughs provided a source of material for exterior levee maintenance. Since that time, regulatory constraints required that all levee maintenance material must be imported or obtained from diked seasonal wetland areas.

Subventions

This Federal/State/local agency cost-sharing component provides financial assistance to local agencies and landowners for the maintenance and rehabilitation of Suisun Marsh levees through the Marsh Subventions Program. Federal/State funding reimburses local agencies for part of the cost to maintain and improve project levees guided by Program procedures. A cost-sharing/deductible arrangement is proposed to improve administrative efficiency, encourage landowner participation in the program, preserve waterfowl heritage use of Suisun Marsh, protect water quality in the Marsh and Delta, provide cost containment, and protect opportunities for future tidal marsh restoration that might otherwise be precluded due to unplanned levee failure.

Special Projects

This component of the program would fund projects more critical than normal maintenance, or will provide additional benefits to the public. Special Projects actions include improvement of levees to provide additional environmental and/or seismic benefits, or where levee failure would affect critical state or federal facilities or operations. The Special Projects component also would focus on microtidal wetlands, habitat levees, and related habitat projects identified by this Plan.

Habitat Levees

Habitat levees are low, wide, gently sloping vegetated levees that may be overtopped during storm surges. This levee design is more compatible with other resource needs than traditional flood control levees. Habitat levees are designed to: 1) minimize predator dispersal and denning; 2) re-establish facsimiles of marsh topographic gradients, 3) accommodate natural patterns of debris deposition and shoreline disturbance; and, 4) provide wave energy buffers. Allowing shallow periodic flooding is expected to promote high marsh vegetation that provides cover for marsh wildlife. Lower crest elevations will facilitate the dispersal of tidal litter, which is an important natural component of tidal refugial habitat (Johnson 1957). Intermittent overtopping by spring tides will flood terrestrial predator dens (rats, raccoons, skunks, fox) where they are not compatible with local management priorities and endangered species recovery.

Emergency Flood Response

Local, statewide, and national resources depend upon maintenance of an effective levee system in the Sacramento-San Joaquin Delta and Suisun Marsh. On-going levee repair, reconstruction as habitat levees, and maintenance will reduce levee vulnerability, reduce future emergencies, and ensure regional availability of construction equipment needed for effective emergency response. However, threats to levee system integrity cannot be eliminated. Therefore, an emergency management and response plan is required to protect Marsh resources.

The goal of the Emergency Response Plan is to create response programs and capabilities to protect or restore critical Marsh resources in case of an emergency. An emergency is a condition

of extreme peril to the safety of persons or property as the result of a threat of levee failure and property inundation. There are three critical components to emergency response:

1) Advance Preparation
2) Immediate Response
3) Post Emergency Recovery

Subsidence Research and Beneficial Reuse of Dredged Material

Presently, there is little or no information characterizing the rates of subsidence found in Suisun Marsh, and few efforts at developing practices for slowing or reversing regional subsidence are known. The subsidence research component of this program places a priority on researching the causes and rates of subsidence within the Marsh by extending on-going investigations in the Delta. This component also anticipates developing recommendations for Suisun marshland management similar to those found to be effective for subsidence reversal in the Delta.

To implement the Levee Program large quantities of fill material will be needed. A beneficial reuse strategy for dredge material collected within Suisun Marsh and from adjacent waterways is one way to provide a local and relatively low-cost source for the fill required.

TIDAL RESTORATION

This Plan targets the creation of 7,000 acres of new tidal marsh in Suisun Marsh consistent with CALFED's ERP restoration targets. This Plan gives the Service the certainty that the agencies are working towards meeting ERP milestones for Suisun Meeting ERP milestones will contribute to meeting the recovery goals identified in the 2001 Administrative Draft Recovery Plan. The Draft Recovery Plan is currently undergoing internal review within FWS and has not been released for public comment. Significant changes may be made to the Recovery Plan following the public comment period. As currently drafted, the Recovery Plan proposes 20,000-25,000 acres of new tidal marsh in Suisun, which includes the 7,000 acres targeted in this Plan.

As part of Amendment Three, the SMPA agencies have earmarked 3.2 million dollars for multi-species benefit. The agencies expect to use these funds for multi-species benefits. These 3.2 million dollars have been transferred to DFG and are currently held in a separate account. The expenditure of these funds requires the approval of the SMPA Negotiators.

Meeting ERP milestones will depend on acquisition of suitable parcels from willing Suisun Marsh landowners. The SCIP agencies have been working towards acquisition of suitable parcels for the purpose of tidal wetland restoration. Since 1999, the SMPA ECAT has been actively seeking parcels from willing sellers for acquisition and restoration. The SMPA ECAT has developed an acquisition checklist to evaluate the suitability of parcels for restoration.

Options for preservation or restoration of wetland habitat within Suisun Marsh include a full spectrum of possibilities, from fully tidal restorations to restoration designs which include dampened tidal range (muted tidal). Site-specific landscape characteristics will largely determine the nature and character of the resulting restoration. For example, higher elevations are more likely to drain sufficiently to permit colonization of certain types of vegetation. Most

sites will be restored to capitalize on existing landscape attributes. Ideally, the resulting restored landscape complex will include a mosaic of landscape elements, some requiring more intensive management and some less.

Some sites are more suited for fisheries and associated aquatic resources, terrestrial species, or waterfowl resources. Land elevation will play an important determining role in the type of restoration. In some cases, it may be possible to satisfy the combined requirements of both aquatic and upland resources, in other cases, the management decision will be to encourage development of one resource base over another.

[cecilia's species accounts]

I. Delta Smelt and Sacramento Splittail

Delta smelt are sensitive to habitat loss and degradation, water project operations and entrainment, exotic species, food supplies, contaminants, and retention in the low salinity zone within the Delta and Suisun Bay. These sensitivities suggest that a complex of inter-related biological, environmental, and anthropogenic factors may regulate the population. Surveys, monitoring, and studies should continue to be done to gain understanding of smelt geographic distribution and response to outflows and transport flows.

While landowners tend to employ minimization measures that protect emergent aquatic vegetation, which provides habitat for both smelt and splittail, ditches have replaced most of the historic tidal channels that existed prior to diking. Natural tidal channels are sinuous or dendritic while straight channels are less able to transport sediment loads, thereby requiring continuous maintenance.

Conservation measures such as creation of spawning and rearing habitat, screening of diversions, and oversight during diversion restrictions are necessary to protect both smelt and splittail. Some tidal marsh restoration projects will target smelt and splittail, particularly in the southern and eastern Marsh. Some alternative waterfowl management strategies, such as microtidal ponds, may also benefit smelt and splittail. The microtidal channels are similar in configuration and tidal range to the upper reaches of tidal sloughs such as Spring Branch. These sloughs are used extensively by native fish, including delta smelt and splittail. The microtidal channels will provide habitat for splittail, stickleback, and tule perch and may provide salmonid rearing habitat and delta smelt habitat (Moyle, P. , U.C. Davis, April 2002, personal communication). Restored tidal marshes should incorporate design criteria that encourage vegetation to support spawning and rearing for smelt and splittail.

Status of Land Acquisition for Tidal Restoration

Thus far, DWR and DFG (Wildlife Conservation Board) have completed appraisals for several properties. Unfortunately the Agencies have been unsuccessful in acquiring property due largely to the time requirements of the land acquisition process, and because appraised values have been unacceptable to the potential willing seller.

ECAT received $536,000 under the 2001 ERP for Suisun Marsh Property Acquisition and Tidal Restoration. This CALFED funding will be cost-shared (50:50) with the 3.2 million SMPA funds.

In October 2001, The SMPA Charter agencies were also recommended for $1.1 million dollars for a proposal under the ERP 2002 funding cycle for property acquisition and tidal restoration.

INVASIVE SPECIES CONTROL

Invasive species control is a necessary element of all management and restoration activities in the Marsh. Problems associated with invasive species as pests, competitors, or predators are not are not unique to restoration activities, and are familiar to agricultural managers using management plans on lands/waterways from smaller to larger spatial scales. Many non-native invasive vertebrates and invertebrates often prove detrimental to native species through indirect or direct competition, or by predation. A regional invasive species control plan is necessary and funding will be sought to develop this plan. Individual projects will address invasive species control as necessary.

The California Department of Fish and Game is currently developing a program for invasive species management and a series of Management Plans for land managers, which will provide guidelines for NIS management in Charter-sponsored projects.

There are several non-native invasive plant species currently of concern for wetland restoration planners, and on-going control measures for these species will be needed as part of implementation post-project monitoring. Plant species needing control include: giant cane *(Arundo donax*), pampasgrass *(Corataderia* sp), perennial pepperweed (L*epidium latifolium),* yellow starthistle (*Centaurea solstitalis).*

VIII. Regional Plans

ZONE DESCRIPTIONS / GOALS/ OPPORTUNITIES AND CONSTRAINTS

For this Implementation Plan, the Suisun Marsh has been divided into seven zones based on hydrological characteristics, targeted species for recovery, opportunities, and constraints. When implemented, this Plan will address CALFED's Phase I goal of tidally restoring 7,000 acres in Suisun Marsh and maintaining 40,000-50,000 acres of managed seasonal wetlands. For maximum flexibility to achieve the total goal, ranges for tidal restoration were established for each zone, as shown in **Table VI-1**. The acreage restored will not exceed 7,000 acres. In addition, this approach addresses SRCD's concerns about identifying individual parcels.

The following zones have been established in Suisun Marsh and are shown on **Figure X**:

- Zone I: Southwestern Suisun Marsh
- Zone II: Northwest Suisun Marsh
- Zone III: Northcentral Suisun Marsh
- Zone IV: Hill Slough
- Zone V: Northeast Suisun Marsh
- Zone VI: Grizzly Island and East Marsh
- Zone VII: South Suisun Marsh

The acreages and types of habitat in each of the seven zones are presented in **Table VI-1** below.

Table VI-1. Zone Acreage by Habitat Type and Restoration Goals

		Existing Habitat Type		Habitat Goals for
Zone	Total, acres	Tidal, acres	Managed, acres	Restoration, acres
I	3,215.31	339.04	2,876.27	1,150-2,800
II	5,970.68	367.79	5,602.89	1,050-1,400
III	9,425.93	2,003.35	7,422.58	350
IV	1,685.70	992.43	693.27	700-1,050
V	4,440.15	964.71	3,475.44	2,500
VI	20,146.09	802.67	19,343.42	0
VII	9,058.44	1,912.80	7,145.64	700-1,050
Totals	53,942.30	7,382.79	46,559.51	6,450-9,150

The location, hydrology, targeted species for recovery, opportunities and constraints for each zone are described below.

Zone I: Southwestern Suisun Marsh

Zone 1 comprises 3,215 acres and is located in the Western Suisun Marsh south of Suisun Slough (**Figure X**), and includes Morrow Island, the Goodyear Slough Unit of the Grizzly Island Wildlife Area, and extensive tidal fringe along the Grizzly Bay shoreline.

Hydrology

This zone has the highest salinity in the Marsh due to heavy influence from Grizzly Bay. Most of the water is diverted to diked managed wetlands from Goodyear Slough and the Morrow Island Distribution System. There is limited freshwater runoff (during storm events) from culverts under Hwy 680.

Targeted species for tidal restoration

Salt Marsh Harvest Mouse, California clapper rail

Opportunities and Constraints

This zone includes existing tidal areas. Clapper rail are known to occur in this zone of higher salinity water. Tidal restoration in this area may provide an opportunity to expand habitat for clapper rail and Salt Marsh Harvest Mouse. The high sediment availability from Grizzly Bay would provide sediment input to raise elevations on tidally restored subsided lands.

The high channel water salinity in this zone increases maintenance activities and costs by reducing the usable life of water control structures. Other constraints for both waterfowl management and endangered species habitat recovery include urban encroachment, minimal upland transition, HWY 680, railroad tracks. The MIDS facility and Goodyear Slough Outfall, while providing an opportunity for waterfowl habitat, represent a constraint for tidal restoration.

Zone II: Northwest Suisun Marsh

Zone II comprises 5,971 acres and is a triangular area bordered by Highway 680 on the west, Cordelia Road on the north, and the Southern Pacific railroad tracks on the east (**Figure X**). The southern extent of this zone is the confluence of Cordelia and Goodyear Sloughs. This zone is primarily in private ownership but includes the DFG's Garibaldi, West Family and Gold Hills Units.

Hydrology

This zone has high seasonal variability in water salinity. In summer and fall the water is more saline due to strong Bay influence. In winter and spring the water can be less saline due to fresh water inflow from American Canyon Creek, Jameson Canyon Creek, Green Valley Creek, Dan Wilson Creek, Suisun Creek, and treated sewage effluent.

Targeted Species for Recovery

California clapper rail, Salt Marsh Harvest Mouse, steelhead.

Opportunities and Constraints

Some acreage in this zone includes upland transition areas. There are opportunities for wetland creation on existing agricultural lands. Jameson Canyon and Green Valley Creeks have high sediment loads available for subsidence reversal. There is an existing steelhead run up Green Valley and Suisun Creeks.

This zone includes an existing waterfowl sanctuary and numerous privately owned waterfowl hunting clubs. The Fairfield Suisun Wastewater Treatment plan discharges treated effluent directly into some waterfowl clubs and Boynton Slough. The treatment plant has plans for additional discharge which may be used to enhance waterfowl habitat on private property. The Southern Pacific railroad tracks and trestle may provide a constraint to tidal restoration. Other constraints include urban encroachment to the west and north, limited sediment source due to distance to bay, and the proposed south of Cordelia Highway 680/80 bypass.

Zone III: Northcentral Suisun Marsh

Zone III, comprised of 9,426 acres is bordered by Southern Pacific railroad tracks on the west, Montezuma Slough to the south, extending east to Beldons Landing. This area is bounded on the north by the Potrero Hills to Suisun City (**Figure X**). This zone includes Rush Ranch, Joice Island Wildlife Management Area, the Peytonia Slough Ecological Reserve and SRCD's Lower Joice Island. This zone includes numerous privately owned managed wetlands, as well as the majority of the existing remnant tidal wetlands in Suisun.

Hydrology

This zone is primarily influenced by Grizzly Bay and Montezuma Slough although some freshwater inflow from Ledgewood and Suisun creeks provides a seasonal influence on salinity in the western portion of this zone. Suisun and Cutoff Sloughs are major Sloughs in this zone.

Targeted Species for Recovery

Soft birds beak, Suisun thistle, California clapper rail, Salt Marsh Harvest Mouse, anadromous fish, delta smelt, and Sacramento splittail.

Opportunities and Constraints

The existing remnant tidal marshes are some of the largest in the San Francisco Estuary. These tidal marshes support populations of clapper rail and rare plants. Opportunities exist to expand populations of these species. Opportunities for public education and outreach would be available with the restoration on public lands. There are existing waterfowl sanctuaries in this zone.

The Southern Pacific railroad tracks and trestle present and obstacle to restoration. Waterfront redevelopment in Suisun City has increased boat and personal watercraft traffic, which damages levees and disturbs wildlife. There is limited sediment availability due to distance to bay.

The Fairfield Suisun Wastewater Treatment plan discharges treated effluent directly into some waterfowl clubs and Boynton Slough. The treatment plant has plans for additional discharge which may be used to enhance waterfowl habitat on private property.

Zone IV: Hill Slough

Zone IV is comprised of 1,686 acres and is located in the northern Suisun Marsh (**Figure X**). This zone bordered on the south by the Potrero Hills and on the North by the Lawler Ranch subdivision and Hwy 12. The western boundary is Suisun Slough and the eastern boundary is the Potrero Hills landfill.

This zone includes the Hill Slough Wildlife Area. Most of the acreage in this zone in publicly owned by DFG. This area includes existing tidal wetlands, seasonally managed ponds, and upland transition zones.

Targeted Species for Recovery

Soft birds beak, Salt Marsh Harvest Mouse, California clapper rail vernal pool species on upland areas.

Hydrology

Hill Slough is at the upper reaches of Suisun Slough. Also, freshwater inflow from McCoy, Union and Laurel Creeks flow into this site. This area receives urban runoff from Fairfield via Laurel Creek and runoff from Travis AFB via Union Creek. The Lawler Ranch "moat" may affect the hydrology of the zone.

Opportunities and Constraints

This zone includes DFG's Hill Slough wildlife sanctuary. Freshwater inflow, upland transition zones, and proximity to existing remnant tidal marsh provide opportunities to expand corridor for wildlife and expand rare plant populations. Most of acreage in this zone is State owned land.

Urban encroachment, water quality concerns from runoff residential areas and Travis AFB and limited sediment availability are constraints to tidal restoration. Restoration actions may pose a risk of flooding Grizzly Island Road. This zone is directly under the runway approach of Travis AFB aircraft.

Zone V: Northeast Suisun Marsh

Zone 5, comprises of 4,440 acres is located in the Northeast Suisun Marsh and includes the Denverton and Nurse Slough areas. This area is east of the Potrero Hills and north of Kirby Hill and bound by Hwy 12 and Shilo Road to the north and east. This area is entirely in private ownership.

Hydrology

Salinity in this area is influenced primarily by Montezuma Slough, and tends to be one of the freshest areas in the Marsh. Most of the managed wetlands flood from Nurse and Denverton Sloughs. In the winter and spring there is minimal freshwater inflow from Denverton Creek and runoff from adjacent uplands.

Targeted Species for Recovery

Salt Marsh Harvest Mouse, vernal pool species, black rail, delta smelt, Sacramento splittail and anadromous fish species.

Opportunities and Constraints

This zone includes properties with extensive upland transition acreage, existing vernal pool habitat. Soils in this zone have a higher mineral content than other Marsh soils and may be less subsided than elsewhere in the Marsh. There is minimal urban disturbance in this region, however this region is directly below the flight path of the Travis AFB aircraft.

Although Little Honker Bay may provide a sediment source for restoration, this zone is far removed from other sediment sources in Suisun.

Zone VI: Grizzly Island and East Marsh

This zone comprises 20, 146 acres on Grizzly Island, north of Roaring River Distribution System and east of Montezuma Slough. This zone includes numerous privately owned managed wetlands and DFG's Grizzly Island Wildlife Area and Cresent Unit, and the Island Slough Mitigation Area. Montezuma Wetlands Project is located in the southeastern portion of this zone.

Hydrology

Source water in this area is obtained from Montezuma Slough and Grizzly Bay. Properties flooding from the eastern end of the Montezuma Slough are provided water with lower salinity due to the operation of the Suisun Marsh Salinity Control Structure. The Roaring River Distribution System provides water to DFG lands on Grizzly Island. Properties flooding from the western end of the Montezuma Slough receive water that is more saline due to influence from Grizzly Bay. Some properties flood with very saline water directly from Grizzly Bay. A large portion of these wetland areas are served by 15 screened diversions.

Targeted Species for Recovery and Enhancement

Salt Marsh Harvest Mouse, waterfowl

Opportunities and Constraints

The presence of multiple fish screen facilities provide opportunities for long term waterfowl management without diversion restrictions. Increased drainage ability and use of pumps could enhance managed wetland operations in this zone. Opportunities also exist for microtidal wetland demonstration project development in this zone.

Tidal restoration in this zone is constrained by the need to build new exterior levees to prevent flooding of adjacent parcels. Maintenance of the levees along Grizzly Bay are important to protect Delta water quality. Additional constraints to tidal restoration include infrastructure such as Grizzly Island Road, natural gas wells, Roaring River Distribution system and numerous residential dwellings. DFG lands on Grizzly Island tend to be isolated from sloughs which constrains tidal restoration.

Grizzly Island Wildlife area provides recreational and educational opportunities, as well as wildlife sanctuaries for tule elk and waterfowl.

Zone VII: South Suisun Marsh

Zone VII comprises 9,058 acres south of the Roaring River Distribution System (**Figure X**). This area includes including Wheeler, Simmons, Van Sickle, Chipps Islands Ryer and Roe Islands. Ryer and Roe Islands are property of the US Navy and include existing tidal areas. The remaining acreage within this zone is privately owned.

Hydrology

Montezuma Slough water, through the Roaring River Distribution System (screened) is the primary source water for these managed wetlands. Properties in the south end of the zone flood from the Sacramento/San Joaquin Rivers. Salinity is influenced in this region by Honker and Suisun Bays.

Targeted Species for Recovery

Salt Marsh Harvest Mouse, Delta smelt, Sacramento splittail, and anadromous fish species.

Opportunities and Constraints

This area is heavily influenced by Delta outflow, and provides fresh water in this region. Tidal restoration would provide habitat for listed aquatic species. However, protection of exterior levees along the Sacramento/San Joaquin River and Grizzly and Honker Bays is considered important for protection of Delta water quality.

Grizzly and Honker Bays provide a sediment source for subsidence reversal.

Other constraints to tidal restoration in most of this zone include major infrastructure such as the Roaring River Distribution System, existing and proposed gas well development, reclamation districts, and the need to construct new exterior levees to prevent the flooding of adjacent parcels.

PROPOSED RESTORATIONS

Zone II -- Tule Belle Microtidal Demonstration Project

The proposed Tule Belle Microtidal Wetland Demonstration Project will convert a privately owned seasonally managed wetland to a managed microtidal wetland. Approximately 22 acres will be converted from minimally managed seasonal marsh to a mosaic of submerged aquatic vegetation (SAV) beds, confined emergent marsh, and upland marsh habitat. The objective of this project is to evaluate waterfowl use of this wetland management strategy. A detailed project description, and monitoring plan for this project are included as **Appendix X**. Specific project features include:

- reconstructed low, wide levees designed for minimal maintenance and high multi-species habitat value;
- extensive beds of native SAV of variable composition, principally sago pondweed with some wigeongrass and other species;
- confined emergent marsh (tule, bulrush, cattail) to provide local cover, habitat diversity, and wind-wave shelter zones;
- channels for circulation, shallow-draft navigation, and confinement of emergent marsh vegetation; and, amenities such as brood water stations, blinds, foot access, and shallow-draft boat launches.

The current owner will retain property rights to this parcel. Restoration will be conducted under a Temporary Entry Agreement between the landowner and DWR. DWR will obtain all necessary environmental permits.

Zone III -- Rush Ranch Managed Pond Restoration

To tidally restore an approximately 72-acre pond at Rush Ranch (**Figure X**). This pond is adjacent to existing tidal wetlands on the Rush Ranch property and fills and drains into Suisun Slough. A conceptual restoration plan for this project is included in **Appendix X**.

This pond is a good candidate for tidal restoration because:

- Adjacent to existing tidal wetlands and known populations of sensitive species
- No Flood liability issues
- Cooperative landowner
- Multi-agency involvement
- NERR designated site

- Public Access
- Educational Opportunities

In addition to the Charter Agencies, this project has the support of the Solano Land Trust, National Estuarine Research Reserve, and the Coastal Conservancy. NERR designation of this site brings additional funding for restoration, interpretive components, and future monitoring and scientific study. The Coastal Conservancy, who provided the original funding for Rush Ranch, has also indicated that they would provide funding to assist in the restoration of this site.

Zone IV – Hill Slough West Restoration

To tidally restore a 200-acre managed pond adjacent to Suisun Slough. DFG received CALFED funding for Phases 1 and 2 of this project and will request additional funding for construction. A detailed restoration plan was completed and is included in **Appendix X.**

Specific project features include:

- Provide 200 acres toward the 350 acre goal for this zone
- Good opportunity to create low, middle, high marsh and upland ecotones

This is a good candidate for tidal restoration because:

- Publicly owned lands
- Proximity to existing tidal areas
- Location provides public educational opportunities

IX. CONCEPTUAL FRAMEWORK FOR THE MONITORING PROGRAM

There are, at a minimum, the following eight monitoring elements associated with any Marsh monitoring plan that will be developed to assess habitat use and biochemical changes taking place as a result of each project. These elements are: SMHM; wildlife; water quality; vegetation; waterfowl; fish; aquatic invertebrate; and bathymetry. Each element of the plan will address specific questions and will have specific objectives. Many of the elements include a comparison of the project site with a reference and/or control site.

Purposes of the monitoring program:

- To document the use of the habitat by target and non-target species.

- To assess physical processes taking place on the project site as a result of project activities. Examples include build up or loss of sediments in the ponds and channels, water circulation patterns on the site, water quality responses to varying tidal ranges.

- To document the biological processes taking place on the project site as a result of project activities: establishment of emergent vegetation, submerged aquatic vegetation, and upland/high marsh vegetation; presence of non-target species; and, use of the habitat by threatened and or endangered species.

All the monitoring elements are related to one another and address the physical, biological and chemical factors associated with taking a seasonally managed wetland and converting it to a managed microtidal wetland.

MONITORING QUESTIONS AND OBJECTIVES

The following section describes monitoring objectives and questions to be addressed for each monitoring element. Additional information on individual monitoring elements including sampling gear and methodology be described in the monitoring plans for specific projects.

1. Salt Marsh Harvest Mouse Monitoring Element – The purpose of this element is to document salt marsh harvest mouse use of a site. Assessment of use or non-use by harvest mouse will be coordinated with assessments of vegetation, water quality, and general project design. General questions to be addressed by this element are:

- Has the habitat improved for salt marsh harvest mouse?
- Have numbers of harvest mouse increased?

Objectives to address the questions are:

- Estimate harvest mouse population on the site.
- Quantify harvest mouse use in emergent vegetation and high marsh communities.
- Assess conditions of use and/or non-use to vegetation development and water quality on-site as well as physical changes due to the project or natural events.

2. Wildlife Monitoring Element – The purpose of this element is to document wildlife use of habitat features. Assessment of use or non-use by wildlife (including California clapper rail) will be closely coordinated and tied to assessments from the vegetation monitoring element, which in turn is related to assessments from the water quality and bathymetry monitoring elements. The general questions to be addressed by this element are:

- What species of wildlife use the various habitat structures provided on the site?
- What project features may limit or enhance wildlife use on the site?

Objectives associated with these questions are:

- Quantify wildlife use in each of the following habitat types: open water, mudflats, emergent vegetation and high marsh communities.
- Assess conditions of use and/or non-use to vegetation, water quality conditions and/or physical changes of project design resulting from natural events.

3. Water Quality Monitoring Element – The purpose of this element is to document water quality conditions on the site at various locations throughout the year. Information from this element will help assess fish and wildlife use and aquatic vegetation success by providing data on temperature, specific conductance, pH, dissolved oxygen, and turbidity. The general questions to be addressed are:

- Are water quality conditions on the site sufficient to support targeted fish, wildlife, and aquatic vegetation?

- Are circulation patterns and tidal exchange sufficient to provide adequate water quality conditions throughout the site year-around?

Monitoring objectives associated with these questions are:

- Provide comprehensive water quality data throughout the year at various stations representing different physical conditions.

- Assess water quality conditions resulting from various tidal ranges.

4. Vegetation Monitoring Element – Vegetation monitoring may include open water submerged aquatic, low emergent marsh, and upland marsh vegetation ecotones. Success of establishing vegetation depends on water quality and upon the interrelationships between elevation and hydrology. The purposes of this element are to document that targeted plant communities are or are not being established; to assess reasons for non-establishment; and to provide information on the relationships between physical processes at the project site and the response of plant communities. The water quality and bathymetry monitoring elements will also provide data that are useful for these assessments. In turn, the vegetation monitoring element will provide information valuable to assessing wildlife use on the site. Questions to be addressed by this monitoring element are:

- What plant communities are being established on the project site?

- How do physical processes at the project site affect the establishment of plant communities?

- What are plant community values (diversity, percent cover, native vs. non-native plants, community structure) at elevation transect sites?

5. Waterfowl Monitoring Element – The purpose of this element is to document waterfowl use of habitat features. Assessment of use or non-use by waterfowl will be closely coordinated and tied to assessments from the vegetation monitoring element, which in turn is related to assessments from the water quality and bathymetry monitoring elements. The general questions to be addressed by this element are:

- Has the habitat improved for waterfowl?

- What species use the various habitat structures provided on the site?

- How are the various species using the habitat structures (loafing, foraging, breeding, roosting)?

- What project features may limit or enhance waterfowl use?

Objectives associated with these questions are:

- Quantify waterfowl use in each of the following habitat types: open water (SAV beds), emergent vegetation, high marsh vegetation, nesting islands.

- Assess conditions of use and/or non-use to vegetation, water quality conditions, disturbance, and/or physical changes of project design resulting from natural events.

6. Fish Monitoring Element – The purpose of this element is to document fish use on the project site. All fish caught will be identified to species and recorded. General questions to be addressed by this element are:

- What species use the various habitat structures provided on the project site?

- What is the abundance and composition of native and non-native species on the site and how does this compare to a comparison site?

- What may limit or enhance native and exotic fish use of the site? (This question may be answered in part by the water quality, bathymetry, and vegetation monitoring elements.)

Objectives to address the questions are:

- Estimate general fish species use.

Monitoring objectives associated with these questions are:

- Track the quality and quantity of plant communities that develop after changing from a seasonal wetland to a managed microtidal wetland.

- Document the interrelationship between physical processes at the site and the response of plant communities over the five-year study.
- Collect data to support analysis of waterfowl, fish and wildlife habitat and other monitoring elements.

7. Aquatic Invertebrate Monitoring Element – This sampling element will collect and identify aquatic invertebrates from the project site. This monitoring element will provide descriptive information on developing aquatic invertebrate communities. Questions to be addressed by this monitoring element are:

- What are the developing aquatic invertebrate communities on the site?
- How does the community structure (number or organisms per square meter, species) compare to adjacent seasonally managed wetlands?

Objectives associated with these questions are:

- Quantify and evaluate aquatic invertebrates from various locations in the project site and compare to samples from the adjacent seasonally managed wetland.

8. Bathymetry Monitoring Element – The bathymetric monitoring element is included to provide above and below water elevation baseline information of important and representative project features immediately after the project site is flooded and to provide information on the erosion, accretion, or subsidence of these features. These features include berms, islands, levees, SAV beds, and excavated channels. Questions associated with this element are:

- What are the settling, siltation or erosion rates (natural succession) of important project features such as islands, channels, SAV beds, berms, and levees?

- What is the relative success of using project islands and berms to protect levees from wind fetch?

- What are the general conditions of levees and berms within the project site as a result of project operation?

Objectives associated with these questions are:

- Provide information on the natural succession of project features designed to provide habitat (channels, SAV beds, berms, islands, and levees).

- Provide information regarding the relative success or failure of project features (project islands, berms, levees).

- Provide information on the general condition of project features (levees, berms, and islands).

SPECIFIC MONITORING PLANS

The following elements will be included in specific monitoring plans, as appropriate: fish, salt marsh harvest mouse, California clapper rail, waterfowl, other wildlife, water quality, vegetation (including listed species), aquatic macroinvertebrates, and bathymetry. Each project will specify principal investigators for each of the monitoring elements. The project manager will coordinate the monitoring elements.

Target Species and Habitat Type

Target species and their habitat along with some criteria associated with the habitat are described in **Table 1**. If appropriate, a primary target species will be identified for each project. For example, the goal of a managed microtidal wetland is to provide habitat for waterfowl that is compatible in use by other marsh species. Therefore, secondary target species for the project include fish, wildlife, and shorebirds. Primary target species for tidal restorations may be salt marsh harvest mouse, clapper rail, vegetation or aquatic species.

Monitoring Elements Design

Monitoring elements will be designed to assess whether the habitat objectives have been met, whether criteria for the habitat have been met, and whether species other than the targeted species are using the habitat. Progress towards meeting the goal of the project will be measured by use of the site by both primary and secondary species.

Other Information and Peer Review

Monitoring plan development will incorporate information from other projects, where appropriate. The project manager will also solicit peer review of the project description and in the development of the monitoring plan.

Table 1. Target Species and Habitat Type

Target Species	Habitat Type
California Clapper rail	• Emergent salt and brackish marshlands • Direct tidal circulation • High marsh areas dense vegetation for nesting • Low marsh areas with sparse vegetation, mudflats and tidal sloughs for foraging. Source: Goals Project 2000
Salt Marsh Harvest Mouse	• Pickleweed dominated vegetation • Middle and upper marsh, i.e., the pickleweed (*Salicornia virginica*) and peripheral halophyte zones Source: Goals Project 2000
Delta Smelt and other Native Species	• Shallow water (3 to 8 feet) encompassing open waters and along the edges of rivers, channels, and sloughs • Dead-end sloughs • Flooded vegetation and vegetated open waters for spawning and rearing of splittail
Rare Plants • Soft bird's beak • Suisun Thistle	• Suisun Thistle Open areas near the upstream end of first-order tidal channels and artificial (mosquito) ditches • Soft birds beak is found Upper peripheral halophyte zone of relic tidal marshes Hydrologic connection to tidal slough system
Waterfowl • Mallard • Pintail • Teal	• Water depth <18 inches • Ratio of emergent vegetation to open water of approximately 50:50 • SAV beds to provide vegetative and invertebrate food sources • Nesting island(s) • Open water (SAV beds) to provide loafing and foraging areas • Upland habitat to provide escape and nesting cover and food for breeding waterfowl Sources: USFWS 1987; Fredrickson and Heitmeyer 1991; Fredrickson and Reid 1988.
Shorebirds	• Mudflats flooded to depths of zero to 2 inches to provide (invertebrate) food sources for shorebirds. • Optimal shorebird habitat greater than 150 feet from disturbance areas (such as footpaths) • Nesting and loafing habitat, including nonvegetated or sparsely vegetated islands. Source: Eldridge 1992

ADAPTIVE MANAGEMENT

Adaptive management is defined as a systematic process for continually improving management policies and practices by learning from the outcomes of operational programs. Its most effective form, "active" adaptive management employs management programs that are designed to experimentally compare assumptions or practices by evaluating alternative hypotheses about the system being managed. The key characteristics of adaptive management include, a) acknowledgement of uncertainty about what action/assumption is "best", b) thoughtful selection of practices, c) careful implementation of a plan, d) monitoring of the key response indicators, e) analysis of the outcome in consideration of the original objectives, and f) incorporation of the results into future decisions.

A. Ecosystem restoration program performance measures and ecological indicators.
Since no long term plan for management of a system as complex as the Suisun Marsh can predict exactly how the system will respond to restoration efforts it is necessary to have a process for assessing the effectiveness of restoration actions. A Technical Advisory Committee (TAC) will be established to develop performance measures, ecological indicators, and appropriate reference sites, and will be composed of one member each from the Charter agencies. [SEE D BELOW—MAKE MEMBERSHIP CONSISTENT]

B. Regional assessment monitoring.
[ADD](To be added: regional monitoring elements for assessing ecological responses to ecosystem restoration actions and marsh wide ecological status and trends.)

C. Ecosystem restoration element/program evaluation.
The TAC will evaluate performance measures, ecological indicators, and other regional monitoring information to assess the ecological responses to restoration actions and determine if goals are being met.

D. Technical Advisory Committee and Program Refinement
A Technical Advisory Committee (TAC) will be formed with one member each from the FWS, BOR, COE, DWR, DFG, and SRCD. The mission of the TAC will be to regularly review the Implementation Plan and revise as more information becomes available through the monitoring, thereby assuring that an adaptive management approach will be used in implementing the Plan. The TAC will identify uncertainties, opportunities, and constraints, restoration targets, action development and selection process, recommended actions, and assessment elements. The aim of this is to refine the Implementation Plan as new information or results become available.

X. DATA AND MONITORING NEEDS

II. Land and Water Surface Elevations in the Suisun Marsh

Land and water surface elevations are key physical variables in Suisun Marsh wetland planning and management. Establishing the relationship between land surface topography and adjacent channel tide height is a fundamental prerequisite for planning levee program elements, wetland restoration design, updating ownership management plans, and accurate computer simulation modeling. Further, detecting *changes* in land surface elevation in response to restoration initiatives and continuing traditional land use is essential for evaluation of trends and adaptive project management.

Geodetic benchmark monitoring and tide stage leveling have historically been done in an ad hoc way with little coordination among responsible agencies. An integrated program is needed to coordinate the various dimensions of land and water surface elevation monitoring.

The Need for a Land and Water Elevation Survey Program

Implementation of the Suisun Marsh Charter depends on six categories of land and water elevation consideration.

1. Geodetic benchmark maintenance
2. Tide stage leveling
3. Spatially continuous topographic mapping
4. Site specific high resolution topographic mapping
5. Sources and rates of land elevation change
6. Channel bathymetry surveys

This section describes the importance and current status of each category.

1. Geodetic Benchmark Maintenance

Maintenance of accurate geodetic benchmarks over time is the foundation of accurate topographic mapping, sea level measurement, and change detection. Numerical modeling of Suisun Marsh hydrodynamics also requires accurate benchmarks to maintain the integrity of sea level data used for calibration and validation of models.

The National Geodetic Survey (NGS) coordinated re-survey of Delta benchmarks in 1997. There is currently no plan for updating the Delta benchmark survey. Moreover, the datum, NGVD 1929, is considered outmoded and should be updated to the NAVD 88 standard. The

Suisun Marsh benchmark network was recently re-surveyed in 2001 by DWR in preparation for radar (GeoSAR) surveys. The Suisun Marsh Compliance and Monitoring Team leveled tide gages based on the benchmark survey in late 2001.

While benchmarks are established in as stable a way as possible, it is well known that Suisun Marsh and Delta levees continuously settle (mechanical compaction), and land surfaces continuously subside (bacterial decomposition of peat soils). There is a need to determine the frequency that benchmarks should be re-surveyed to meet the accuracy needs of managed wetlands, the levee maintenance program, restoration project planning, and modeling.

There is a need for CALFED and participating agency support for improved maintenance of geodetic benchmarks in the Suisun Marsh and Delta. Benchmark maintenance is the foundation of high-resolution restoration project surveys, channel bathymetry surveys, regional elevation surveys (GeoSAR), accurate modeling, and change detection to support adaptive management.

2. Tide Stage Leveling

Once benchmarks are re-surveyed to a common datum on the Marsh and Delta, the immediate task is to level the Suisun Marsh and Delta tide gage network. Once completed, the integrated up-to-date benchmarks and stage gages would provide the basis to support

- model calibration and verification
- pre and post restoration project tidal prism impact analysis
- estimation of water and scalar fluxes in the Marsh and Delta
- analysis of tidal wave propagation and energy dissipation
- modeling estimation of extent and duration of tidal inundation under alternative restoration designs

There is a need for CALFED and participating agency support for improved maintenance of tide stage levels in the Suisun Marsh and Delta.

3. Spatially continuous topographic mapping

DWR is coordinating a program to create a digital elevation model (DEM) of the Suisun Marsh based on airborne radar-based terrain mapping system using interferometric synthetic aperture radar technology. This technology (GeoSAR) promises to improve terrain mapping from current photogrammetry techniques because it is foliage penetrating and can produce a true ground surface DEM. It is a public-private partnership that will provide the DEM at little cost in return for the opportunity to improve the technology.

The forthcoming GeoSAR DEM will be accurate to within one to two feet. Using GIS tools, the DEM will allow the Suisun Marsh Charter Implementation to determine the

- Location and extent of the Marsh with existing intertidal land elevation
- Relationship between plant communities and elevation for various land uses (in combination with the DFG vegetation survey).
- Restoration potential of available properties

The DEM also provides the basis for "draping" other spatial data sets, including vegetation, roads, orthophotographs, and other spatial data together.

There is a need to continue the existing partnership and to expand the GeoSAR application to the Delta. CALFED ERP and Levee program would also benefit from participation.

4. Site specific high-resolution topographic mapping

High-resolution topographic maps are a first order data need for potential Suisun restoration projects. Accurate topographic maps, along with vegetation maps and other geo-referenced site information help identify potential levee breach sites, locations of historical channels, new infrastructure siting (duck blinds, docks, parking) levee heights, and cut and fill alternatives. There is a recognition of the importance of accurate project specific surveys and a need for restoration project proponents to employ surveyors experienced in Marsh conditions and the needs of restoration project design.

5. Sources and rates of land elevation change

The ad hoc nature of benchmark maintenance in the Suisun-Delta area has limited the ability to detect trends and mechanisms of land elevation change. However, elevation change is often a primary goal of wetland restoration projects on subsided land. There is a need to develop monitoring protocols that will allow assessment of the mechanisms of land elevation change.

Land surface elevation changes have several overlapping causes including

- Settlement and compaction under load (especially on levees)
- Bacterial decomposition of organic carbon in peat soils
- Regional subsidence due to gas or groundwater extraction
- Wind erosion of exposed soil

Wetland restoration projects should include plans for integrated elevation monitoring to simultaneously observe and separate the processes leading to elevation change.

6. Channel bathymetry surveys

Delta and Suisun Marsh bathymetry surveys have advanced since 1997 with the integration of depth sounder and GPS technology. DWR maintains a bathymetry database containing over 1.4 million point elevations. The data has been collected since 1934 by various agencies with varying levels of horizontal and vertical control. New technologies are on the horizon that will be able to "image" channel bathymetry in real-time.

It is well known that the accuracy of hydrodynamics models is critically linked to the accuracy of bathymetry data. Channel bathymetry is also dynamic over time. Bathymetry trends suggest that the estuary is receiving less sediment input in the last 30 years leading to net depletions of bed elevations over much of the system. There is a need for continuous CALFED and agency support for accurate bathymetry surveys of the Suisun Marsh.

Surface Elevation Data Needs

The Suisun Marsh Charter Group recognizes the need for and recommends the establishment and funding of a coordinated interagency program to capture land and water surface elevation trends. Specifically, the following actions are recommended to establish reliable land and water surface elevations in the Suisun Marsh.

- CALFED and participating agencies should establish and fund a coordinated interagency program to capture land and water surface elevation trends.

- CALFED and participating agencies should support improved maintenance of geodetic benchmarks in the Suisun Marsh and Delta. Benchmark maintenance is the foundation of high-resolution restoration project surveys, channel bathymetry surveys, regional elevation surveys, accurate modeling, and change detection to support adaptive management.

- Develop monitoring protocols that will allow assessment of the mechanisms of land elevation change including bacterial decomposition of peat soil, mechanical settlement, wind erosion, mineral accretion, bio-accretion, and regional impact of gas extraction.

- CALFED and participating agencies should support improved maintenance of tide stage levels in the Suisun Marsh and Delta.

- Restoration project proponents should employ surveyors experienced in Marsh conditions and the needs of restoration project design.

- Continuing and expand the existing partnership with GeoSAR and include applications to the Delta. CALFED ERP and Levee program would also benefit from participation.

- CALFED and participating agencies should support continuous and accurate bathymetry surveys of the Suisun Marsh.

SALINITY VARIABILITY MONITORING AND ANALYSIS RECOMMENDATIONS

The Suisun Marsh Charter Group recognizes the importance of salinity variability (enhancement and control) to the range of beneficial uses in the Marsh. The following specific analysis and field monitoring are recommended to increase understanding of the mechanisms of the environmental response to salinity variability.

- Salinity variability should be specifically addressed as conceptual models are developed in support of planning for restoration and enhancement of Suisun Marsh wetland functions.

- Include salinity variability in the development of conceptual models that support planning for restoration and enhancement of Suisun Marsh wetland functions.

- Conduct a systematic follow-up on SEW conclusions related to salinity variability. The Suisun Marsh Technical Team should develop and carry out methodologies to close data gaps identified by all SEW committees. Specifically, the time scales and degree of control of salinity variability should be identified for the impact of channel water salinity on chemical/biological response of the aquatic ecosystem, marsh soils, brackish marsh vegetation, resident and migrating fishes, birds, and terrestrial vertebrates.

- Conduct a summary review of the evidence related to the historical salinity regime of the Suisun Marsh including stratigraphic analysis and historical accounts. The Suisun Marsh Charter Group recognizes that a complete description of historical salinity variability is the necessary first step toward connecting salinity variability to environmental responses. Consideration of the long-term trend of flow and salinity in the Suisun Marsh is useful for setting the context of future restoration efforts. Understanding the historical trends will elucidate restoration alternatives in the framework of the vast landscape changes that have already occurred.

- Conduct an analysis of the impacts of the Suisun Marsh gate on the magnitude and variability of salinity for the entire Suisun Marsh region.

- Use the approach outlined by Knowles (2000) in an analysis of Montezuma Slough to index the magnitude and variability impact of the SMSCG on salinity on annual, seasonal and tidal time-scales. The Suisun Marsh Technical Team should establish the scope, for this analysis, and review the results.

SUISUN ECOLOGICAL WORKGROUP (SEW) RECOMMENDATIONS

Four SEW subcommittees made recommendations for additional research and monitoring. A list was submitted to the CALFED Comprehensive Monitoring Assessment and Research Program (CMARP). The complete recommendations (Chapter 8 of the SEW Final Report) are included below:

Brackish Marsh Vegetation Subcommittee

- Studies to determine the spatial and temporal variability of structure and dynamics of tidal wetland plant communities. Determine the relationship of vegetation pattern to depth and duration of flooding, soil salinity, soil redox potential, soil pH, and channel water salinity.

- Studies to determine the critical life stages and range of edaphic requirements of sensitive plant species, including listed species and species recognized to be in decline, which could become further endangered by management actions.

- Studies to track the spread of invasive species in the marsh. Determine the dynamics of invasive species and their relationship to aqueous salinity regimes.

- Studies to track the distribution of rare plants in the marsh.

- Comparative study of tidal marsh and managed marsh communities to determine mechanisms promoting species diversity.

Waterfowl Subcommittee

- Studies to determine the distribution, abundance, and nutritional value of plants used as food by wintering waterfowl. By identifying plants important in the diet of waterfowl wintering in Suisun Marsh, managers may meet the needs of waterfowl by practicing better water management techniques that promote the growth of nutritious, preferred food plants.

- Studies to determine the relationship between waterfowl brood survival and channel water salinity. Grizzly Island has some of the highest mallard nesting densities in North America. The question of what happens to broods post hatch in Suisun Marsh needs further study. To better estimate Suisun's contribution to the Pacific Flyway, it would be helpful to know how many ducklings survive the critical 14-day period when they are most sensitive to channel water salinity, and how many broods survive to fledge.

- More extensive waterfowl population surveys in the marsh to determine habitat choice or preference. Through examination of these preferred habitats, it should be possible to determine desirable salinity levels.

- Studies to evaluate salinity tolerances of aquatic invertebrates used as food by waterfowl. This information may exist, but to date has not been found. An intensive literature search is likely required; however, commissioning work with existing data sets (i.e., DFG Bay-Delta Salt Slough system in the San Joaquin Valley) may reveal some answers.

- Determine how food availability influences clapper rail distribution and fitness by assessing the abundance and productivity of invertebrate prey items, and how these prey items are influenced by temporal and spatial variations in salinities in tidal marsh.

- Determine the extent of intermarsh movements by clapper rails within Suisun Marsh and with other marshes in the San Francisco estuary, and how dispersal and colonization movements are related to marsh size, shape, position, habitat characteristics, and population dynamics.

Aquatic Habitat Subcommittee

- Suisun Marsh is thought to be an important refuge for native species that exist in the Bay-Delta region. Given this, what are the impacts of the invasions of *Potamocorbula amurensis* (Asian clam), *Acanthomysis bowmani* (an Asian mysid), *Eriocheir sinensis* (Chinese mitten crab), and *Tridentiger bifasciatus* (Shimofuri goby) on native aquatic species in the marsh? Has the introduction of these species into the estuary increased the relative importance of the marsh as a rearing area for juvenile fishes? What are the population dynamics of these invasive species and how are they affected by channel water salinity in the marsh? If low outflow caused by drought and diversions facilitates the establishment of nonnative species, what level of outflow would protect against future invasions?

  Special studies should be conducted to determine which water quality parameters affect the spread of invasive species. Studies should also be conducted to determine whether significant interactions (competition, predation, interference, etc.) exist between species that have recently invaded Suisun Marsh, and how these invasive species are impacting marsh species. Future monitoring should include sampling of benthos.

- How is the decline in chlorophyll a, zooplankton, and *Neomysis mercedis* impacting fish in Suisun Marsh? What is the distribution and abundance of zooplankton in the marsh? Future monitoring should include more widespread sampling for zooplankton.

- How does the aquatic habitat in Suisun Marsh compare to other habitats in the Bay-Delta region?

  A special study comparing the secondary productivity in Suisun Marsh with that of other habitats in the region would provide important information on the role of Suisun Marsh in the Bay-Delta estuary.

- What is the role of shallow water habitat in Suisun Marsh? What is the feasibility of altering the structure of existing levees (e.g., creating "benched levees") in some locations in the marsh to create shallow water habitat?

  The Aquatic Habitat Subcommittee's initial investigations suggest that the availability of shallow water habitat plays a greater role in species abundance and distribution than does salinity. Shallow water habitat provides refugia, spawning and rearing areas, and supports a much broader food chain than do channelized sloughs. In addition to any special studies addressing the role of shallow water habitat, the subcommittee recommends that a monitoring program be implemented to characterize and track long-term changes in marsh habitat (channel morphology, plant types, etc.) using GIS.

- What quantity of "salinity habitat" (habitat in the optimal salinity range for a given species) exists for different species of fish in Suisun Marsh?

Unger (1994) and others have suggested that the X2-Abundance relationships found in Suisun Day can be partly explained by the covariance of X2 and habitat availability. Characterizing the relationship between species salinity preferences and habitat availability is more complex in Suisun Marsh, due to the influence of freshwater inflows and managed wetland operations. The subcommittee recommends investigating ways to characterize these relationships.

- What is the optimal salinity range for various sensitive fish species in Suisun Marsh? What arc the impacts of outflow, the success of invading species, toxic compounds, quantity and quality of shallow water habitat, on recruitment success of larval and juvenile fishes?

  More information is needed regarding the early life stages of Suisun Marsh fishes (Bennett and Moyle, 1996). Special studies that increase our understanding of sensitive species in Suisun Marsh need to continue. More information on which factors have the greatest impact on early life stages of Suisun Marsh fishes is needed to expand our understanding of aquatic ecosystem dynamics.

- What impacts do the Suisun Marsh Salinity Control Gates have on the distribution, movement, and abundance of fish and aquatic invertebrates in Suisun Marsh?

  The subcommittee recommends that a monitoring program be developed that clearly examines the impact of operation of the gates on aquatic resources in Suisun Marsh. One study that has specifically examined the impact of gate operations on aquatic species is the SMSCG Adult Salmon Migration Evaluation was conducted in 1993 and 1994. A related study currently in its third year is the SMSCG Salmon Passage Study, which is being conducted to determine whether a modification to the SMSCG flashboard design facilitates fish passage. Future monitoring should examine the impact of gate operations on abundance and distribution of phytoplankton, zooplankton, mysids, and resident and seasonal fishes. Further, studies should be conducted to determine whether gate operations deter or promote the abundance of normative species.

- What is the effect of duck club management on the water quality in Suisun Marsh? What is the impact of managed wetland drain water on aquatic organisms in receiving sloughs? If club management has an adverse impact on aquatic species, what alternative management strategies can be used that would be less harmful to aquatic species?

  Scientists from UC Davis studying fish abundance and distribution in Suisun Marsh have occasionally observed fish kills in the smaller dead-end sloughs that are apparently due to the discharge of poor quality (possible anoxic) water from the managed wetlands into these sloughs. A special study or monitoring program should be implemented to determine the impact of these periodic events.

- What is the role of contaminants from urban runoff in the Suisun Marsh ecosystem? Future monitoring should include sampling for contaminants.

- What is the role or effect of the Fairfield sewage disposal into Boynton Slough in Suisun Marsh?

  Fish abundance appears to be lower in Boynton Slough than in other areas of Suisun Marsh. A special study to examine the impact of the effluent inflow on fish abundance and diversity would be useful.

- What effect does freshwater inflow from creeks have on the channel water salinity of Suisun Marsh? What effect does this have on the aquatic organisms present in Suisun Marsh sloughs?

  The Western Salinity Control Test conducted by DWR demonstrated that increased freshwater flows to the western Suisun Marsh significantly reduced salinity in the affected sloughs. A special study or monitoring program could investigate the effect of freshwater inflow on resident fish in Suisun Marsh.

- What is the relationship between X2 and the distribution and abundance of aquatic species in Suisun Marsh? What is the relationship between X2 in Suisun Marsh and X2 in the Bay-Delta estuary? Do the X2 standards in Suisun Bay provide adequate protection for aquatic species of Suisun Marsh?

  Initial investigation by the subcommittee revealed no apparent correlation between the position of X2 and abundance of aquatic species in Suisun Marsh. However, it is possible when salinities that are optimal for various fish species occur at the entry points to the Suisun Marsh, there may be greater opportunities for aquatic species to move into and use Suisun Marsh. The subcommittee recommends investigating the salinity-fish abundance relationship from this perspective.

Wildlife Subcommittee

- Comprehensive surveys to determine distribution and relative abundance of all wildlife species (such as salt marsh harvest mice, clapper rail, western pond turtle, river otters, mink, etc.) within Suisun Marsh. Studies should compare tidal vs. managed wetland habitats. Special studies for threatened and endangered species should include incidental information for other non4isted species.

- Studies to determine optimal salt marsh harvest mouse habitat in a brackish marsh environment, in both tidal and managed wetlands, including: percent cover, percentage of pickleweed, percentage of open ground, plant community associations, duration and depth of inundation, water and soil salinities, and marsh geomorphology to produce these habitat conditions.

- Determine the extent of interhabitat movements by salt marsh harvest mice within Suisun Marsh and how dispersal and colonization movements are related to habitat patch size, shape, position, vegetation, and populations.

- A genetic study of harvest mice should be undertaken. Recent surveys for the endangered salt marsh harvest mouse have found many harvest mice with field characteristics intermediate between the salt marsh harvest mouse and the more common western harvest mouse. Mitigation, management and recovery effort for the salt marsh harvest mouse would be greatly assisted by a genetic study to differentiate between the two species and determine whether they are hybridizing.

- A comparison of seasonal dispersal ranges and survival of small mammals in tidal and diked wetlands of Suisun Marsh.

- Studies to determine how changes in channel water salinity spatially and temporally affect habitat types in both managed and tidal wetlands.

- Studies to determine physiological salinity tolerances for life requirements of Suisun Marsh wildlife (such as clapper rails, pond turtles, black rails, river otters, etc.).

- Studies to quantify the relationship between reproductive success, juvenile and adult survival and habitat use for clapper rails and salt marsh harvest mice in Suisun Marsh.

- Conduct bathymetry surveys of the marsh covering all wet areas so that accurate representations of the amount and location of shallow water habitat can be assessed. Characterizing the effect of bathymetry and topography on structure and function of plant, animal, and fish communities is basic and essential.

- Conduct continuous channel salinity and tide stage data to reference sensitive tidal wetlands such as Hill Slough tidal marsh, Peytonia Slough Ecological Reserve, and Rush Ranch/Cutoff Slough tidal marsh.

- What effect does freshwater inflow from creeks have on the channel water salinity of Suisun Marsh? What effect does this have on the aquatic organisms present in marsh sloughs?

- The Western Salinity Control Test conducted by DWR demonstrated that increased freshwater flows to the western Suisun Marsh significantly reduced salinity in the affected sloughs. A special study or monitoring program could investigate the effect of freshwater inflow on resident fish in the marsh.

- What is the relationship between X2 and the distribution and abundance of aquatic species in the marsh? What is the relationship between X2 in the marsh and X2 in the Bay-Delta estuary? Do the X2 standards in Suisun Bay provide adequate protection for aquatic species of Suisun Marsh?

- Initial investigation by the Aquatic Habitat Subcommittee revealed no apparent correlation between the position of X2 and abundance of aquatic species in the marsh. However, it is possible that when salinities that are optimal for various fish species occur at the entry points to the marsh, there may be greater opportunities for aquatic species to move into and use the marsh. The Aquatic Habitat Subcommittee recommends investigating the salinity-fish abundance relationship from this perspective.

- What is the relationship between channel water, pond water, and soil water salinity in the managed wetlands?

- Obtain holistic data regarding interaction of food web linkages between tidal wetland plant communities by intertidal plant zone and adjacent terrestrial and aquatic food webs.

- Identification of potential keystone species that may serve as management targets for marsh ecosystem sustainability.

- Evaluation of current hydrodynamic and salinity models and their applicability for use as management tools in tidal wetland systems.

WATERFOWL FEEDING STUDY

[Missing Text]

OTHER NEEDS

[Missing Text

XI. Permitting Requirements

This Implementation Plan reflects the intent of the participating agencies to derive a plan for the Marsh that will include the requirements of the SMPA and also be compatible with the CALFED strategic goals and objectives for Suisun Marsh and with the CALFED ROD. Consistent with this intent and with the CALFED Programmatic EIS/EIR and ROD, the agencies will ensure Implementation Plan compliance with all applicable environmental laws and regulations, including permit requirements. The agencies will also utilize the CALFED *Guide to Regulatory Compliance for Implementing CALFED Actions* and coordinate as appropriate with CALFED's Permit Clearinghouse, a process to coordinate and facilitate permit applications and approvals and compliance with the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA).

Table VIII-1 lists environmental regulations that may be most pertinent to Suisun Marsh projects implementing the CALFED long-term plan. **(Note to reviewers: This is a draft list, not necessarily considered to be complete.)**

Table VIII-1. Environmental Regulations and Permits

National Environmental Policy Act
California Environmental Quality Act
Federal Endangered Species Act
California Endangered Species Act
Natural Community Conservation Planning Act
Magnuson-Stevens Fishery Conservation and Management Act
Fish and Wildlife Coordination Act
Clean Water Act (Section 404/Section 10 of Rivers and Harbors Act; Section 401)
Indian Trust Assets
State Water Resources Control Board and Regional Water Quality Control Board permits and authorizations
Clean Air Act
National Historic Preservation Act
Executive Order 11988 - Floodplain Management
Executive Order 11990 - Protection of Wetlands
Executive Order 12898 - Environmental Justice
Migratory Bird Treaty Act
Section 1600 Lake or Streambed Alteration Agreement
Suisun Marsh Local Protection Program
Other Local Regulatory Compliance
Compliance with Hazardous Material Laws and Regulations
Disabilities Regulations - Americans with Disabilities Act, Rehabilitation Act, and Architectural Barriers Act

National Environmental Policy Act /California Environmental Quality Act

The CALFED Program achieved programmatic compliance with NEPA and CEQA, and other environmental laws, during the CALFED Phase II. Implementation of Phase III actions, including the Suisun Marsh ERPP restoration targets included in this Implementation Plan, will require project-level environmental review, permitting, and other regulatory compliance. The CALFED Phase III consists of implementation over a 30-year period of a variety of site-specific actions that are components of the Preferred Program Alternative analyzed in Phase II; the Phase III actions will be implemented in stages, with Stage 1 consisting of the first 7 years of implementation.

The actions contemplated in the Implementation Plan will be accomplished over a period of several years, subject to a variety of both opportunities and constraints. As such, the Plan includes some elements that are well defined and could be implemented relatively quickly, such as Amendment Three to the SMPA and specific tidal restoration projects, whereas other elements, including larger scale tidal restoration, will be more completely defined in the future. Thus, this Plan is both project-level and programmatic.

It is intended that Implementation Plan actions will require completion of a project-level NEPA and CEQA document that tiers from the CALFED PEIS/EIR. However, careful review of the final Implementation Plan as well as the Suisun Marsh-specific environmental analysis in the CALFED PEIS/EIR by the lead Federal and State agencies will determine the type and level of NEPA and CEQA compliance ultimately required.

The U.S. Bureau of Reclamation will be the lead Federal agency for NEPA compliance, and the California Department of Water Resources will be the lead State agency for CEQA compliance. Reclamation and DWR will work closely together and with the benefit of both technical expertise and legal counsel to determine the appropriate NEPA/CEQA compliance for the Implementation Plan, including those elements that are now well defined as well as the future, programmatic elements.

If Reclamation and DWR determine that environmental analysis beyond that contained in the CALFED PEIS/EIR is needed, then one possible approach may include preparation of a programmatic EIS/EIR that would focus on the programmatic elements contained in the Implementation Plan. On a parallel path, the agencies may initiate implementation of the well-defined elements of the Implementation Plan through the environmental assessment/initial study process, assuming a finding of no significant effects/negative declaration.

Federal/California Endangered Species Acts

The Fish and Wildlife Service and the National Marine Fisheries Service have indicated their intent to each prepare a programmatic biological opinion for the Implementation Plan. These programmatic biological opinions will tier from the CALFED biological opinions and specifically address programmatic components of the Implementation Plan as well as the well-defined elements of the Implementation Plan so implementation of the well-defined elements

may progress. For the programmatic ERPP restoration elements of the Implementation Plan, next-level ESA compliance will use Action Specific Implementation Plans (ASIPs).

An ASIP is an environmental review document created by the CALFED process to quickly implement the MSCS (Multi-Species Conservation Strategy). ASIPs incorporate the information requirements of the Federal Endangered Species Act and the California Natural Community Conservation Planning Act in one format. An ASIP tiers from the program-level biological opinions and explains how an action implements and adheres to the programmatic conservation strategy described in the CALFED MSCS.

FWS, NMFS, and DFG will assist and advise lead agencies/project proponents during the preparation of ASIPs. FWS, NMFS, and DFG also will coordinate their comments regarding each completed ASIP and will ensure that the requirements for compliance with the Federal Endangered Species Act and Natural Community Conservation Planning Act are consistent and are not duplicative.

Corps of Engineers Permit for Suisun Marsh Maintenance Activities

A critical component of the Implementation Plan will be the Suisun Resource Conservation District's and individual landowners' ability to continue to conduct needed maintenance activities on managed wetlands within Suisun Marsh. The current Corps of Engineers Regional General Permit No. 3 for activities in the Suiusn Marsh Primary Management Area expires November 15, 2005. This permit was authorized under the previous biological opinion issued by the FWS to the Corps, pending completion of the joint consultation initiated by the Corps and Reclamation for RGP No. 3 and Amendment Three to the SMPA.

(Note: This section to be expanded.)

A) Specific Actions vs. Programmatic

B) List of Potential Permits and Timelines

C) ESA Consultation

   i) SMPA Consultation [In Outline, but not here]
   ii) IntraFWS Consultation [In Outline, but not here]

D) Alternatives Analysis

E) Design Review Group

Permits, Biological Opinions, and Other Regulations

Permits are required for any construction in the Marsh, including levee construction or repair, and dredge or fill operations. A number of management operations may also require permits.

The relevant history of permit authorizations for SMPA activities in the Marsh is documented in **Exhibit XXX. [Appendix? JD has this appendix]**

Under **[LIST LAWS AND/OR REGS – Cecelia?]** permitting agencies are required to obtain biological opinions from appropriate agencies when a project is expected to have significant impacts on fish or wildlife. The biological opinion can then be used to establish conditions of the permit. Biological opinions provide a scientific basis for water right decisions, CALFED goals and objectives, and for this Suisun Marsh Charter Implementation Plan.

[NOTE: Instead of listing laws and/or regs above, Cecilia deleted the above, and substituted the following:
Any Federal agency which funds or permits an action which may affect threatened or endangered species is required to consult with the U.S. Fish and Wildlife Service or the National Marine Fisheries Service. If an action is likely to have an adverse effect on listed fish, wildlife, or plant species, the Services issue biological opinions for the project. Terms and conditions of a biological opinion can become terms of a permit or funding action.]

The following are the primary agencies that issue permits for activities in the Suisun Marsh, and their relevant permit responsibilities:

> BCDC: Serves as the permitting agency for all major projects within the Primary Zone, which includes tidal wetlands and diked lands managed as wetlands. In the Secondary Zone, uplands and lands adjacent to the Marsh, BCDC serves as an appellate body with limited functions.
>
> COE: The U.S. Army Corps of Engineers (COE) is the primary agency responsible for flood control, bank stabilization and levee and dam construction, and protects navigable waters and adjacent wetlands under Rivers and Harbors Act of 1899 and Clean Water Act of 1972. Under Section 404 of the Clean Water Act, COE's permitting process regulates the discharge of dredge or fill material into waters or adjacent wetlands.
>
> SWRCB: This agency, along with nine Regional Water Quality Control Boards, regulates water quality in all the State waters. The SWRCB sets water quality standards and administers the state's permit system to appropriate and divert surface water. Together, the beneficial uses and the water quality objectives established to protect them are called "water quality standards" under the terminology of the Federal Clean Water Act. The SWRCB issues water right decisions to implement the standards, and requires monitoring to enforce them.

The Suisun Marsh and landowners are also subject to regulation by local and regional agencies. Significant regional regulations affecting the Marsh involve mosquito control and agricultural burning.

The Solano County Mosquito Abatement District (SCMAD) is responsible for mosquito abatement, and must be notified within 24 hours when lands are flooded so the property can be inspected for mosquito breeding. The property owners are financially responsible for the costs

of mosquito abatement on their properties. SCMAD works with landowners to assure that the land is managed to control mosquitoes, and may direct draining of lands or require landowners to pay for SCMAD actions to abate mosquitoes on their lands.

Some plants, such as cattails, are best managed by periodic burning, and owners must comply with all agricultural burning regulations. Burning permits for the Marsh are now issued by DFG, and landowners must coordinate burns with the Solano County Sheriff's Dispatch and the Suisun Fire Protection District. The Regional Air Quality Control Board has allowed controlled burns in the Suisun Marsh during the spring and fall.

New regulations proposed by the Bay Area Air Quality Management District would add new requirements in the Suisun Marsh and a new fee schedule for Marsh burning. These changes would include requiring landowners to file a lengthy smoke management plan that would have to be approved by the BAAQMD prior to burning. After approval of the smoke management plan and the payment of fees, the landowner would have to call **[an air pollution control officer?] [is that what "APCO" is?]** for burn allocations and final permission to burn based on daily meteorological conditions.

Additional information about mosquito abatement and agricultural burning is in **Appendix X and X**. [JD has these]

XII. Estimated Costs, Responsible Party and Funding Opportunities

The Charter agencies envision that funding the habitat and levee improvements will be challenging. Implementation of the Actions described in this plan are estimated to cost _____.

FUNDING AND AGENCY RESPONSIBILITY

The SMPA agencies acknowledge that they will be responsible for a portion of the costs of implementation of this Plan. The SMPA agencies will look to CALFED and other sources to fund much of the habitat restoration to meet the CALFED milestones and levee improvements implemented as part of this Plan.

The objective of the SMPA, signed in 1987, was to maintain a dependable water supply to mitigate adverse effects on the Marsh of CVP and SWP (and a portion of the adverse effects of other upstream diversions). This agreement obligated the DWR and USBR to pay for the planning, design, construction, operation and maintenance costs of facilities constructed in Suisun Marsh. DWR pays 60 percent of these costs and USBR 40 percent. Twenty percent of the DWR portion is to be from funds appropriated from the legislature to finance the mitigation responsibility of upstream diverters. Since 1987, DWR and USBR have spent _____.

During the Amendment Three consultation with the FWS, the DWR and USBR acknowledged their responsibility to fund mitigation beyond that of [CB deleted but did not revise seasonal wetland species]. In the Amendment Three Agreement, the Agencies agreed to use the Phase III mitigation funds for "multi-species" benefit and transferred $3.2 million to the DFG in 1999.

In 2001, CALFED agreed to fund a proposal submitted by the SMPA ECAT for the acquisition and tidal restoration of property in Suisun Marsh. This proposal requested $536,000 from CALFED, and offered the Amendment Three mitigation funds to cost share 50:50.

The Charter Agencies submitted another proposal requesting 1.71 million during the 2002 CALFED [spell out] (PSP). In addition, DWR, in collaboration with the Fisheries Foundation, submitted a proposal to CALFED for 1.83 million to restore Chipps Island. CALFED is expected to make their funding recommendations during Spring 2002.

Other potential funding sources to pay for restoration described in this plan include the Morrow Island Distribution (MIDS) fish screen funds and CALFED directed funds. The biological opinion for maintenance dredging on the MIDS in 1998 included a condition that a fish screen be installed on the intake to MIDS. The agencies agreed that a greater benefit to the resources could be achieved by using the fish screen funds (estimated at between 2 and 4 million dollars) for fisheries habitat restoration.

CALFED-directed funds include funds that have been requested as part of the CALFED Levee Program for levees and habitat restoration in Suisun Marsh. These funds are estimated at _____ over a 5-year period (?).

In addition, efforts are underway to pass legislation which would provide funds for improvements to Suisun Marsh Levee.

SMPA VS. CALFED RESPONSIBILITY

a) Amendment Three Actions

b) Seasonal Wetland Enhancement [In Outline, but not here]

c) Microtidal Demonstration Projects

d) Tidal Restoration

e) Levees
Habitat Levees
Flood Control

AVAILABLE FUNDING SOURCES

Existing and Proposed

Future Funding Opportunities

[NOTE: TABLE HERE? OR IN SECTION 1? Needs introduction.]

Restoration Funds

Existing Funds	
SMPA Amendment Three (for multi-species benefits)	$3.20M
2001 CALFED ERP funds (acquisition for tidal restoration	$0.50M
Sub-total	$3.70M
Requested CALFED Funds	
Charter Group proposal tidal restoration property acquisition (ERP 2002)	$1.71M
Chipps Island (ERP 2002 proposal)	$1.83M
Sub-total	$3.54M
Other Funds	
MIDS fish screen mitigation funds	?
CALFED directed funds (levees and habitat restoration	?
Total Restoration Funds	**$7.24M**